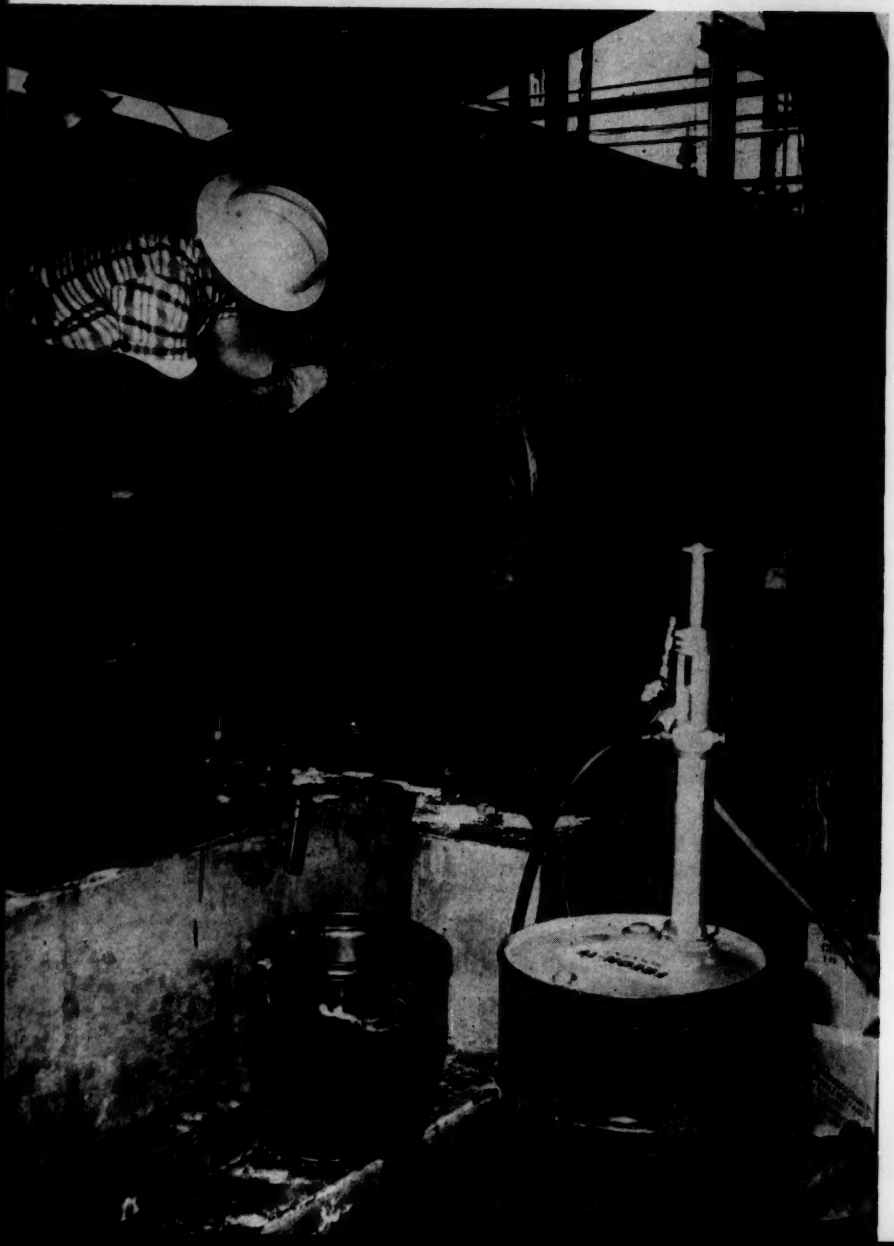
INDUSTRIAL REFRIGERATION



DRYNESS

best reason in the world for specifying

genetron®

SUPER-DRY REFRIGERANTS

In "Genetron" Super-Dry Refrigerants, moisture has been reduced almost to the vanishing point. "Genetron" 12, for example, has less than one-thousandth of one per cent of moisture! And the tight quality "specs" for "Genetrons" are usually *bettered* in production. "Genetron" Super-Dry Refrigerants are available from wholesalers everywhere. So be sure to make your next order—*"Genetron."*

QUICK FACTS on GENETRON Super-Dry Refrigerants

- Guaranteed exceptionally low moisture content.
- Noncorrosive to standard equipment materials, nontoxic, nonflammable, stable, safe.
- Critical and freezing points well outside range of operating uses.
- Solvent action on oil helps prevent solidification or congealing of lubricant; aids in lubrication of equipment; generally miscible with oil.
- Freely interchangeable and may be mixed in any proportions with comparable fluorinated hydrocarbons meeting the same strict refrigerant specifications.
- Available everywhere, from refrigeration wholesalers throughout the country.

GENETRON 11 ORANGE LABEL CCl_3F
Trichloromonofluoromethane

GENETRON 12 WHITE LABEL CCl_2F_2
Dichlorodifluoromethane

GENETRON 22 GREEN LABEL $CHClF_2$
Monochlorodifluoromethane

GENETRON 113 PURPLE LABEL $C_2Cl_3F_3$
Trichlorotrifluoroethane

GENETRON 114a BLUE LABEL $C_2Cl_2F_4$
Dichlorotetrafluoroethane

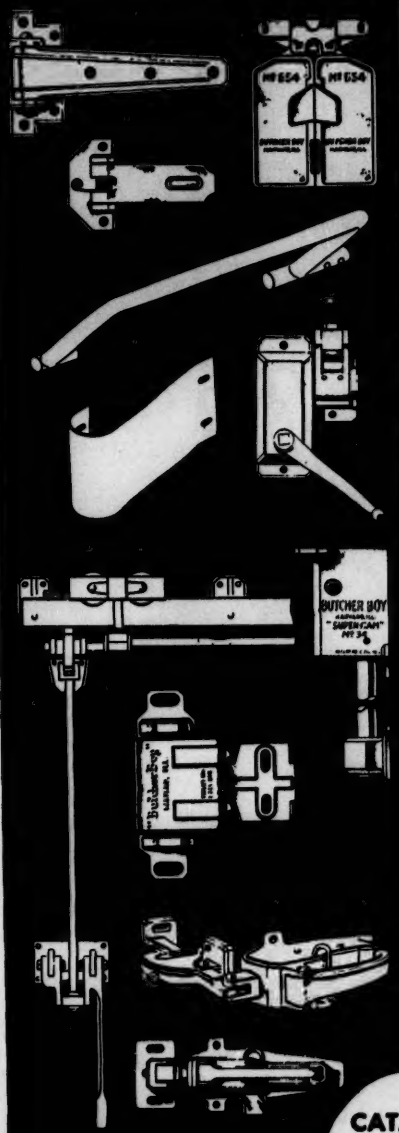
Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.

"Butcher Boy"

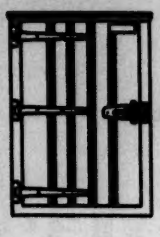
Refrigerator Doors

REFRIGERATOR DOOR HARDWARE



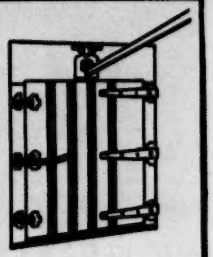
SAFETY RELEASE FASTENERS
No. 11 or No. 12
Permit opening from within even though padlocked from outside

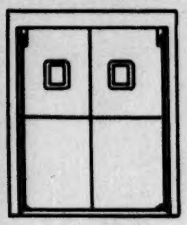
CATALOGS AVAILABLE UPON REQUEST



STANDARD COOLER-FREEZER DOORS

- Modern Streamlined Appearance
- 100% Douglas Fir Construction
- Massive and Durable Hardware



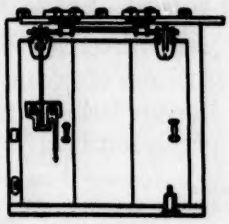


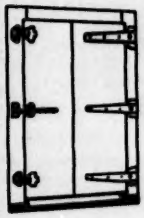
STANDARD VESTIBULE AND AUTO CLOSE DOORS

- Double Acting Doors for Loading Docks
- For Heavy Trucking Openings
- Save Refrigeration Losses

HORIZONTAL SLIDING DOORS

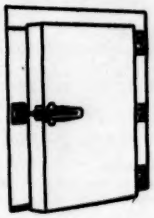
- Ideal where space factor is limited
- Recommended for Freezer Areas
- Available for manual, air, or electric operation
- Mechanically operated doors open and close in less than 4 seconds





LOW TEMPERATURE INFITTING AND SUPER FREEZER OVERLAP DOORS

- Low Temperature Doors for +10 to —20° F
- Super Freezer Doors for —0 to —100° F
- Both types available with No. 51 electric defrosters
- Extra heavy duty hardware applications

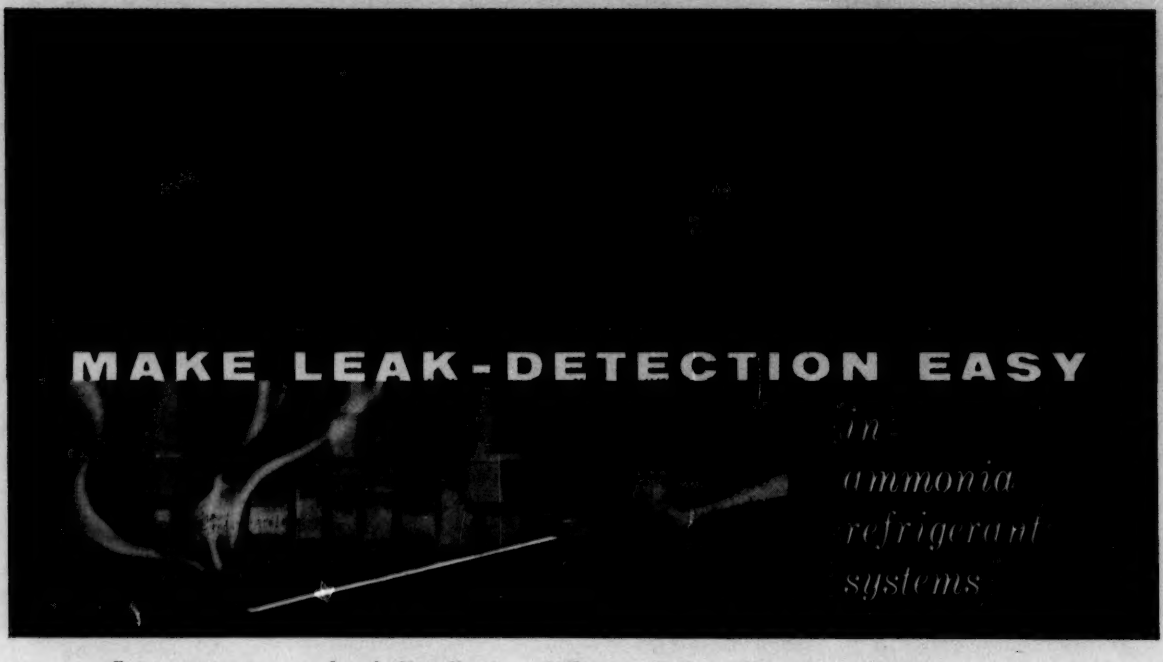


New!

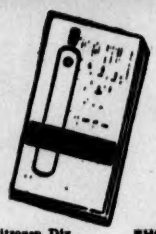
FULLY AUTOMATIC ELECTRIC DEFROSTERS

- Underwriter's Approved—An exclusive First with Butcher Boy
- Flexible "silicon" covered (*not* lead covered) heater cables
- Furnished with calibrated "thermostat"—economical heat control

BUTCHER BOY REFRIGERATOR DOOR CO. Dept. "RD" HARVARD, ILLINOIS



...Just contact your local distributor of Barrett® Brand Anhydrous Ammonia, listed below. He'll be happy to supply you with handy "Sulfstix" Ammonia Leak Detectors. And you can count on him for prompt, courteous service on Barrett Brand Ammonia – the purest, *driest* refrigeration grade ammonia you can buy!



COLORADO
Denver: Mine & Smelter Supply Co. 3800 Race St. P. O. Box 9041

CONNECTICUT
W. Hartford: The Christian Petersen & Son Co. 26 Brook St., P. O. Box 247

FLORIDA
Jacksonville: D. W. Anderson 615 E. Bay St. P. O. Box 1346
Miami: Columbia Chemical & Supply Co., 7430 N.E. 4th Ct. P. O. Box 907
Tampa: Food Equipment & Supply Co., 1809 2nd Ave. P. O. Box 422

GEORGIA
Macon: The Anderson Chemical Co., Inc., 1620 Waterville Rd. P. O. Box 1424

ILLINOIS
Centralia: Kem-I-Kal Engineering Laboratories, Inc., Pearcy & Broadway
Chicago: Westland Engineering Supply Co. 53 W. Jackson Blvd.

INDIANA
South Bend: Mid-Continent Chemicals, Inc. 2217 So. Main St.

IOWA
Burlington: McKesson & Robbins, Inc., West Central District Off. 100 N. 4th St. P. O. Box 591
Cedar Rapids: McKesson & Robbins, Inc. Cedar Rapids Div., 900 2nd St., S.E.
Ottumwa: J. W. Edgerly & Co., 120 W. Main St.
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Paterson: Seaboard Industries 195 Keen St.
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Bklyn: Tex-Ite Products Corp. 555 Park Ave.
Buffalo: Commercial Chemicals, Inc., 211 Hertel Ave.
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New York: E. M. Sergeant Pulp & Chemical Co. 7 Dey St.
Poughkeepsie: Duso Chemical Co., Inc., Fulton & Fairview St. P. O. Box 665
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NORTH CAROLINA
Charlotte: Acme Soap & Chemical Co. Pineville Road

OHIO
Cleveland: Harshaw Chemical Co., 1945 E. 97th St.
Cincinnati: Merchants Chemical Co., Inc. 2933 Spring Grove Ave.
Toledo: Inland Chemical & Solvent Corp. 1775 Dorr St.

OKLAHOMA
Okla. City: Rex Engineering & Sales Co., 2735 N.W. 10th St. P. O. Box 5141
Tulsa: Vaughn Chemical Co. 1102 E. 3rd St.

PENNSYLVANIA
Altoona: Western Pennsylvania Chem. Co., Inc., 4125-41 6th Ave. P. O. Box 703
Avoca: Lunox Chemical Works Inc., Box 7
Pittsburgh: Thomas Knoch 244 Bascom St.

RHODE ISLAND
Providence: T. H. Baylis Co. 42 Gano St.

TENNESSEE
Memphis: The Lilly Co. 466 Union Ave.

TEXAS
Big Spring: T & T Supply Company, Inc. 1380 East Third Street Big Spring Texas
Dallas: Chas. H. Platter & Co., Texas Bank Bldg. P. O. Box 5998
El Paso: George S. Thompson Co., Inc., 611-615 N. Campbell St.
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San Antonio: Ryan Brokerage Co., Transit Tower

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Burlington: Valcour Chemical Co., So. Champlain St.

VIRGINIA
Richmond: Phipps & Bird, Inc. 303 S. 6th St.

WEST VIRGINIA
Charleston: B. Preiser Co., Inc., P. O. Box 6118

WISCONSIN
Cottage Grove: North Central Chemicals, Inc.
Green Bay: Wisconsin Refrigeration Supply Co. 1016 Velp Ave.
Milwaukee: Benlo Chemicals 1907-25 S. 89th St.

Allied Chemical

NITROGEN DIVISION
Dept. CA 6-11-6, 40 Rector Street, New York 6, N.Y.

February, 1959

Number 2

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Hamburger Story Deferred; Royal Castle To Be Spring Feature

▶▶ LAST MONTH under News of Things To Come, IR announced that the February issue would carry a feature on the Royal Castle System Commissary, Miami. This feature over the by-line of Richard L. Francis is deferred until Spring. The hamburger and bun are ready but the pickles, onions and lettuce trimmings were slightly behind schedule.

Contents

Quality Shortening By Rapid Cooling 8

▶ Shortening is now manufactured right in the middle of the edible oil producing area. HumKo Company, manufacturers of shortening, salad oil and margarine oil, recently opened one of the most modern oil processing plants in the U. S. at Champaign, Illinois, the heart of the soy bean growing area.

Refrigeration, plays a major role in the manufacturing of the shortening, not only in processing of ingredients but in the tempering and storage of the product. *The plant has its own refrigerated warehouse and hydrogen producing facilities.*

Safe Solvents For Motor Maintenance 14

▶ It is a sound business practice to keep the windings of electric motors free of oil, grease and solid particles. The presence of these soils overheats the insulation, causing power losses and greatly reduced insulation life.

There are many procedures for cleaning motors, but great danger of causing insulation damage in many of them. Fluorinated hydrocarbon cleaners are proposed as a solution to the problem of removing soil, yet not damaging insulation, varnishes, etc.; particularly for cleaning equipment in place.

Pay Attention To The Details 22

▶ Facts and figures illustrate the financial folly of ignoring details. This presentation by a technical service engineer reviews basic concepts of moisture, oil, heat and fluorinated hydrocarbon refrigerants as combined in a refrigeration system. An example is given in which some of the rudiments of good practice were not observed during installation and initial operation.

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Cover: Clean-In-Place Method Developed For Motors

▶▶▶ DEMONSTRATED IN FILM at the NAPRE meeting in November was a new method of cleaning large industrial motors in place. Motors are cleaned with a safe solvent developed by du Pont. A direct acting pump supplies a solid stream of solvent for washing soil from encrusted motor windings. Solvent is harmless to motor parts and insulation.

Published Monthly by NICKERSON & COLLINS CO.
General Offices: 433 N. Waller Ave., Chicago 44, Ill. Teles.: AUstin 7-1303-04-05

DOW | INSULATION

STYROFOAM® *stops moisture, repels heat*

Superior properties make Styrofoam outstanding for low-temperature pipe covering.

There are just three things most people ask of a low-temperature pipe insulation. That it . . .

(1) stop costly heat gain, (2) prevent condensation and dripping, (3) stay trim and effective without maintenance.

Pipe covering made of Styrofoam* does an outstanding job all three ways, and at surprisingly low applied cost. The reasons are: Styrofoam has a low "K" factor that stays low permanently because of this insulation's unyielding resistance to water vapor. (This is the same Styrofoam that has been so widely used as a low-temperature room insulation by leading companies everywhere during the last 10 years.)

Styrofoam is effective as a vapor seal, and will not crack or split in extremely cold or rapidly changing temperatures. It is not subject to ice build-up around valves. And Styrofoam is lightweight, easy and economical to apply. Coatings for both indoor and outdoor use are available and are easily applied in the field.

The companies listed below manufacture a complete line of pipe covering made from Styrofoam, as well as a wide variety of equipment and tank insulating segments. See them about your low-temperature pipe covering problems. Or write to Plastics Sales Dept. 2223BU2.

*STYROFOAM is Dow's registered trademark for its expanded polystyrene

Manufacturers

Fastab Insulation, Inc., 304 Cleveland Transit Building, Cleveland 14, Ohio • Fibrous Glass Products, Inc., Alpa Plaza, Hicksville, L. I., New York • Glo-Brite Products, Incorporated, 6415 North California Avenue, Chicago, Illinois • Kennedy Industries, 4447 Alger Street, Los Angeles, California • Kransco Manufacturing Company, 503 Railroad Ave., South San Francisco, California • MMM, Incorporated, P. O. Box 968, Portsmouth, Ohio • Robinson Industries, 3051 Curtice Road, Coleman, Michigan • Styro Fabricators, 1401 Fairfax Trafficway, Kansas City, Kansas • Styroformics, Inc., 17 Hawkins Street, Somerville, Mass. • Tuffilite, Inc., Ballston Spa, New York

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

Experience proves

STYROFOAM

has the best combination of insulation properties

SUPERIOR INSULATION
Permanent low "K" factor

OUTSTANDING WATER RESISTANCE
Stays dry and effective

HIGH COMPRESSIVE STRENGTH
3000 pounds per square foot

EASY TO HANDLE
Lightweight, can be cut with ordinary tools

RESISTS ROT
will not attract vermin

ECONOMICAL
low in-place cost, low cost-per-year service

DOW

news briefs—

American Ice Buys Into U. S. C. S.

▶▶ SLIGHTLY OVER ONE-THIRD of U. S. Cold Storage Co. stock was purchased late in December 1958 by American Ice Co. from the New York Central Railroad. Purchase price was not disclosed although estimated at over $1 million.

Pillsbury's Greenville In Production

▶▶ REFRIGERATED FOODS PLANT of the Pillsbury Co. at East Greenville, Pa., went into full production on January 15. Partial production began in September 1958. Kraft Foods Co. distributes Pillsbury's refrigerated fresh dough product line. Other Pillsbury plants are located at Louisville, Los Angeles, Atlanta and Denison, Texas, with new plants under construction at New Albany, Indiana and Midland, Ontario.

Fresh Water From Sea Water

▶▶ CONTRACT FOR DEVELOPMENT of a system of producing fresh water from saline supply has been awarded by the U. S. Dept. of the Interior. This pilot plant capable of producing 15,000 gpd will cost $150,000. Intended as an 18-month experimental project, if found successful, may eventually result in a one million gpd demonstration plant. The pilot plant will operate on the principle of freezing fresh water crystals from the brine, seperation of the crystals and their remelting for a fresh water supply.

Congress Will Study FTC Food Report

▶▶ ACCORDING TO QUICK SHEET, NARW, the Federal Trade Commission's investigation of the food industry will pay particular attention to frozen foods marketing. According to Senator Hubert Humphrey, there is vigorous and sometimes unscrupulous competition for limited retail freezer cabinet space; and other bad marketing practices.

SWIMA Locates Permanently

▶▶ ANNOUNCED EARLY IN JANUARY, was the new permanent location of the Southwestern Ice Manufacturers' Association, Inc. at 1101 Adolphus Tower, Dallas 2, Texas, phone RIverside 1-5862.

Adohr Adds Refrigerated Loading

▶▶ ADOHR MILK FARMS, Los Angeles, completed in January, a distribution plant which features a refrigerated dock building. This loading facility is equiped with a central floor chain conveyor system for high speed loading of delivery trucks.

Cherries From New Zealand

▶▶ First cherries ever exported from New Zealand were received in Honolulu in January. The consignment from the Rapaura Orchards of Ivory Orchards, Ltd., Marlborough, were transported from Auckland to Honolulu by refrigerated ship in their fresh state.

Richmond Continues Litigation

▶▶ FOLLOWING Federal Court award of damages to Merchants Ice and Cold Storage, reported in IR last month, the City of Richmond filed a motion to have the jury verdict set aside. If the motion is overruled, the city wants a new trial.

California Export Pier Discontinued

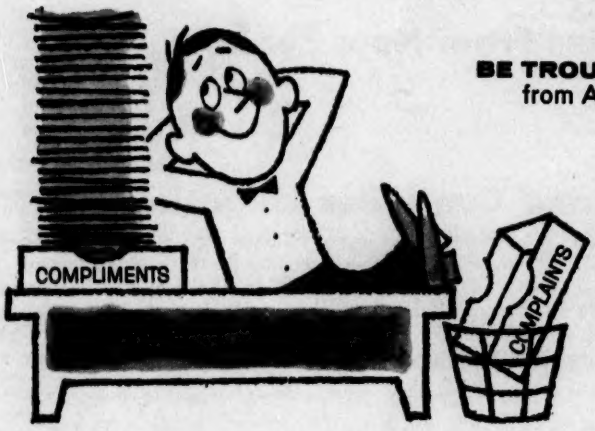
▶▶ Port of San Francisco Cold Storage Plant, owned and operated by the State of California, has been discontinued. Located on a pier at Third Street and Embarcadero, the refrigerated facilities are being dismantled for bid sale.

MARCH—Bought lower grade ammonia at bargain price on supplier's vague quality claims . . .

LATER—Moisture in ammonia . . . expansion and float valves frozen . . . flow hindered and then stopped . . .

STILL LATER—Oil film on evaporators and condensers . . . heat transfer reduced. Head pressure and power costs up . . .

TOO LATE—Plant slowdown. Efficiency off. Operating costs up . . . and profits down . . .



BE TROUBLE-FREE! Buy the trouble-free ammonia from Armour—purest money can buy!

ARMOUR AMMONIA DIVISION

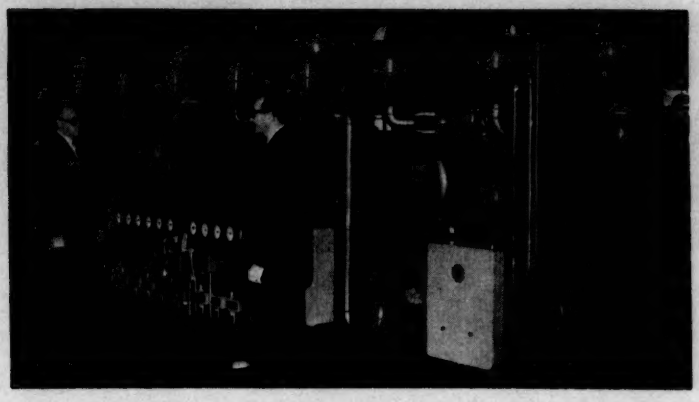
1355 West 31st Street • Chicago 9, Illinois

Quality ammonia from the most distribution points . . . 171 cylinder stock points, 12 bulk stations!

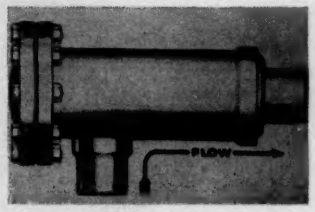
What's New

MACHINERY
APPLIANCES • PROCESSES

H&AC Show Observations Condensed



George C. Oliver Co. District of Columbia air conditioning contractor, was recipient of this packaged Thermotrol liquid chilling plant. For installation in the Americana Motel, it is said to be one of the largest models (240 hp) ever built by any manufacturer.



New line of cartridge type angle filter driers was introduced by Henry Valve Co. Multiple cartridge units permit a drying and flow capacity range up to 100 TR.

Precision machined fitting covers are now available as companion pieces to the line of anti-sweat pipe covering made of Styrofoam.

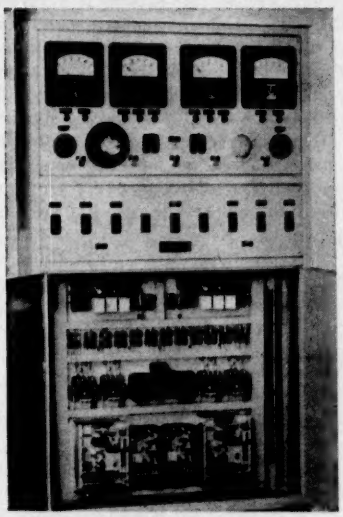
▶▶▶ EXHIBITORS at 14th International Heating and Air Conditioning Exposition coupled their showings with much publicity on new or improved products. Advance coverage and available literature at and (still available) following the show gives the potential buyer ample reading material.

▶ With the idea of helping its readers conserve some time in their literary research, INDUSTRIAL REFRIGERATION, in this issue features a high light or two from among the many categories; such as, what is perhaps one of the largest items of unitary air conditioning equipment; a unique motor base; a free-standing control center (by a newcomer in the air conditioning field); smaller and more compact starters; and electronic motor operators. New lines of fittings and driers were introduced as typified by the fitting pictured here-in; and, more anti-sweat pipe insulations were introduced, such as Styrofoam fitting covers.

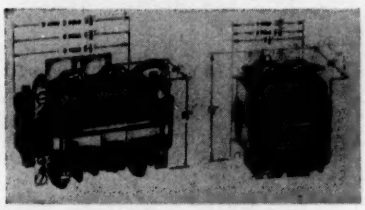
▶ Fire resistant duct, including flexible types for higher pressure systems were exhibited. Announced at the time another large manufacturer displayed a new lithium bromide absorption system, was a new phenolic lined container for the chemical. Tools were featured to a minor extent, but a new masonry cutter appears worthy of mention.

▶ Three products aforementioned were not suitably illustrated for this issue. One, a tilting motor was introduced by a Milwaukee firm. It is engineered on the principle that action and reaction are equal but opposite, which gives the motor base a reactive torque directly proportional to the horespower. This increases the belt tension or decreases it as the load varies.

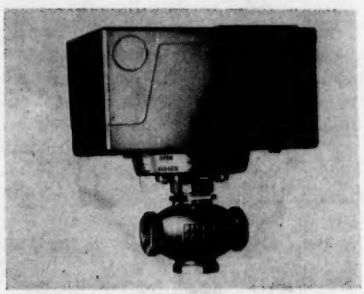
(Continued On Page 38)



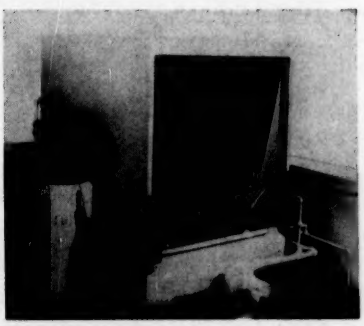
These factory assembled free standing panel control centers for power, heat and process applications are produced to customer specifications.



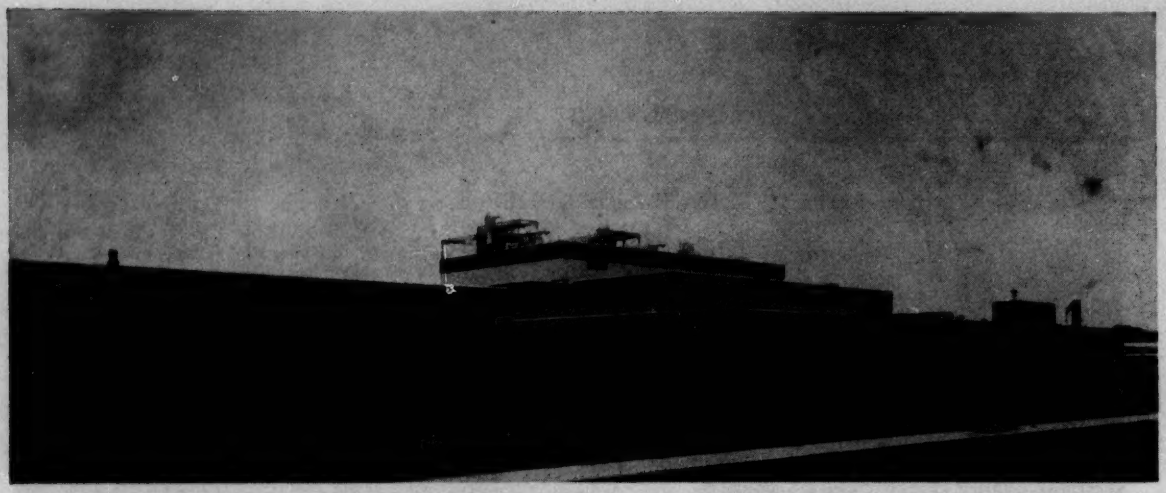
Use of a new line of 30-amp. starters and contactors was noted in a number of control panels displayed in the Heating and Air Conditioning show. They were specifically designed for controlling refrigeration compressor.



Compactness and simplicity are achieved for damper and valve control in heating, ventilating and air conditioning systems by the new motor operator introduced by a Rockford, Ill. firm. Flexibility is achieved through application of transistor components in electronic circuitry for 115 volts.



Water treatment is still a major maintenance problem with air conditioning and refrigeration systems. Pictured is an automatic water treatment regulator which continually synchronizes the rate of chemical feed and water bleed-off with the load on the system or water evaporated.



QUALITY SHORTENING BY RAPID COOLING

By SCOTT CASSELL
Chicago Correspondent
Industrial Refrigeration

▶▶▶NEW ECONOMIC LIFE and business was recently brought to the Midwest farm area when HumKo Company, manufacturers of shortening, salad oil and margarine oil, opened one of the most modern edible oil processing plants in the country at Champaign, Illinois. With home offices in Memphis, Tennessee, HumKo officials selected Champaign as the site of their new plant because it is in the heart of the soy bean growing area and would eliminate transporting the oil to Memphis for processing.

To guide the planning, construction and operation of this new plant, HumKo sent a team of home office trained men to Champaign to work with the construction engineers in laying out the plant. With an eye to later smooth and efficient operation, General Manager Arthur H. Wood, Plant Production Superintendent Giles Colbert, Plant Engineer J. Harold Robinson and Chief Chemist William J. Howard lived with the plant as it grew up.

Foresight in giving consideration to utility conservation, stage phasing of refrigeration, and process equipment location during the construction period, has already indicated dividends in water, fuel, power economies and in process efficiency. Their plans even included HumKo's security and fire protection; with the fire fighting unit already proving the value of this thinking by dousing a tool shop blaze before local fire department equipment could be gotten to the plant.

Refrigeration Maintains Proper Finishing Conditions

As in other processing operations, both refrigeration and heat play an important part in edible oil processing. Refrigeration is vital in transforming the partially processed oil into a creamy consistency and crystaline content which will later harden properly into plastic shortening that will give best baking and cooking results.

The refrigeration system which so successfully holds finishing temperatures at the most effective level is a result of general design and specifications by HumKo engineers. It includes Votators, their suction traps, a rotary booster, four multi-cylinder compressors, three inter-coolers, three evaporative condensers and receiver, plus an oil still. This NH_3 system is described by Plant Engineer J. Harold Robinson as one which protects the compressors against shock loads and removes foreign materials (such as entrained water and oil from processing) from the refrigerated ammonia—resulting in a clean and efficient refrigeration system.

Votation During Finishing Heart Of Sales Appeal

While certainly other phases of edible oil processing are vital, none effects the sale of the finished product so much as Votation during the finishing phase. Crude soy bean oil, received from nearby areas in tank cars, is first put through a refining process where it is centrifugally separated from gums and impurities, water washed and vacuum dried. Then it is bleached by heating and agitation in kettles with a bleaching compound, and filtered.

At this point the oil undergoes hydrogenation, in which it is reacted with hydrogen and in presence of a catalyst is transformed from a liquid into a plastic at normal temperatures. Further distillation removes objectionable odors. It is then ready for finishing.

Load Shock On Compressors Overcome By Stage Phasing

Refrigeration enters the picture. Here the power conservation and compressor protection are important to operating economy and efficiency as the relatively hot liquid is rapidly chilled like ice cream, into a semi-solid by Votation.

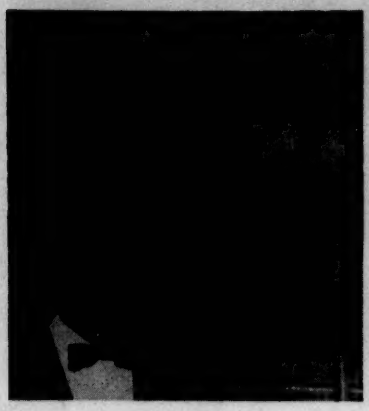
The chilling temperature of the Votators brings the oil temperature down to a range of from 150° F to 75° F depending upon other processing conditions. This temperature, plus the creaming action of the Votators, determines the crystaline structure of the semi-solid material which is so important to good baking properties in the final product.

Refrigerant temperature demands, depending on process requirements, range from minus 8 F to minus 40 F. The refrigerant (ammonia) being subjected to the shock of chilling a hot liquid so rapidly, takes on considerable superheat and must then itself be precooled before being returned to the compressors for compression.

Two-stage, Split System Gives Utmost Utility

Adaptability for load variation is the most outstanding feature of the refrigerating system at HumKo. Planned as a two-stage, split system, it may be run completely single stage, or two-stage for low temperatures

Personnel From HumKo Memphis Plant Instrumental in Champaign Success



HumKo General Manager Arthur H. Wood is pictured under the mural depicting the merger of area agriculture with HumKo processing.

Department heads at Champaign pose under composite Memphis-Champaign plants photo-mural. L. to r., Gene Davis, scheduler, Steve Dobrowski, traffic manager, Harold Robinson, plant engineer, Joseph Dow, office manager and Giles Colbert, plant superintendent.

and/or several higher temperatures whenever peak production load requires big volume refrigeration. At other times when the production load is at less than peak capacity, the system may be run at split temperature levels and used to supply both high and intermediate refrigeration temperatures simultaneously.

Remote Compressor Room

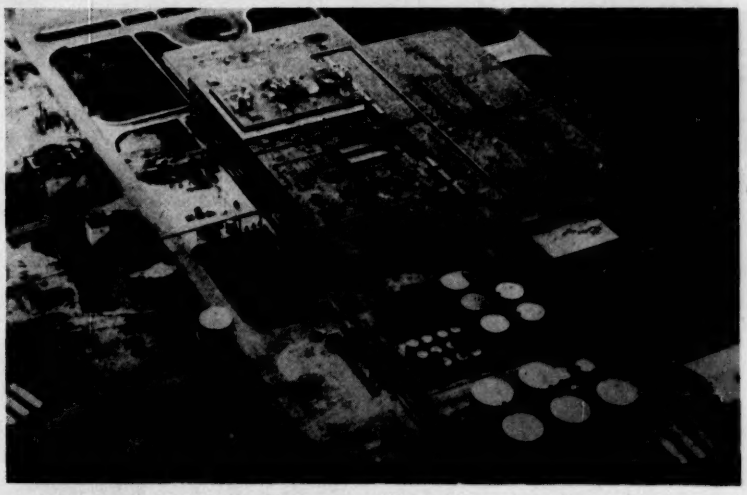
In this arrangement of hook-ups, the rotary booster takes suction from the low temperature low side liquid cooled suction trap and discharges to the intermediate intercooler for two-stage operation. It is this pre-cooling phase in the refrigeration system that eliminates superheat and possible entrainment shock to the compressors, as well as effects system hp reductions. The high stage compressors take suction from the intermediate intercooler and/or high temperature high side intercooler. All three intercoolers are controlled by electric float actuated controls, thus eliminating possible errors of human judgment and providing automatic operation.

NAPRE Engineer

Plant Engineer Robinson, Past President of Memphis NAPRE chapter and well known as a hospital engineer in that city, pointed out that the oil still is operated only when the Votators are "down" to prevent a loss of operating time. He said that the still functions with steam distillation and water to reclaim lubricating oil and remove unwanted material from the ammonia, so that the Votators and compressors receive the ammonia at its peak of purity to achieve an efficient refrigeration job.

Again underscoring the thought put into this installation, the location of the compressor room indicates good planning. While the Votators are located properly in the path of the moving oil, the refrigeration system is housed in a separate room which is convenient for equipment maintenance and large enough for future equipment additions. At present the compressor room houses the four multi-cylinder compressors, rotary booster, intercoolers, oil still and a control panel for operation regulation and supervision.

Condensing water for the refrigerating plant is cooled by means of the three evaporative condensers installed just outside the machinery room and connected by the required piping, through the wall. Water passing through these units is circulated to one of three make-up water tanks for pre-evaporative cooling heat extraction. Other auxiliary refrigeration compression systems (there are two more) are cooled from the tower which also supplies coolant water to the hydrogen plant, which was pictured on the Cover of January IR.

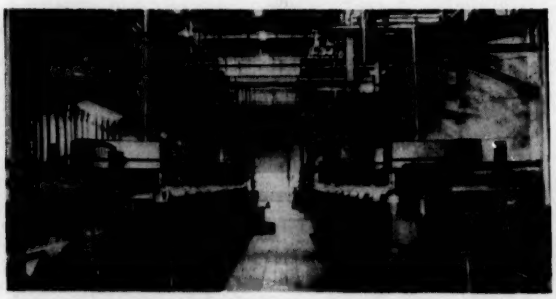


Aerial view of the HumKo Champaign, Illinois Plant. Low flat building at top of central group is the office building. The refinery is in the center of the major group, part being that which is elevated above the first level.
Boiler and compressor machinery rooms are located at the opposite end of the refining building from the offices. The building running the length of the refinery at right of the covered rail siding, is the warehouse and packaging building. Controlled atmosphere storage is employed.
White building at extreme lower right is the drum shop. Cooling towers at top left serve the refinery while the single tower and pond serve the hydrogen plant. Tanks in foreground store both raw and processed shortening oils.

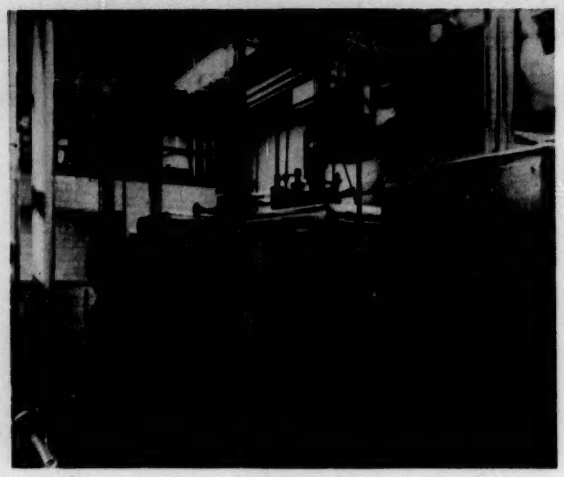
SHORTENING—ITS MANUFACTURE THE STEP-BY-STEP STORY

Tank cars mark the beginning and the completion of the shortening story at HumKo. Although the cars pictured here are outbound with salad and margarine oils, other cars bring in crude edible oils, such as cotton seed, soy bean and some peanut and coconut oil. Tank trucks also make some deliveries and pick ups.

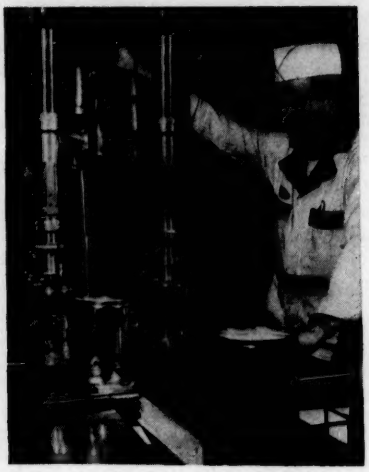
From tanks to storage and vice versa, is the story of raw and finished oils respectively. The HumKo plant has its own small tank farm as shown in the aerial view, page 7.



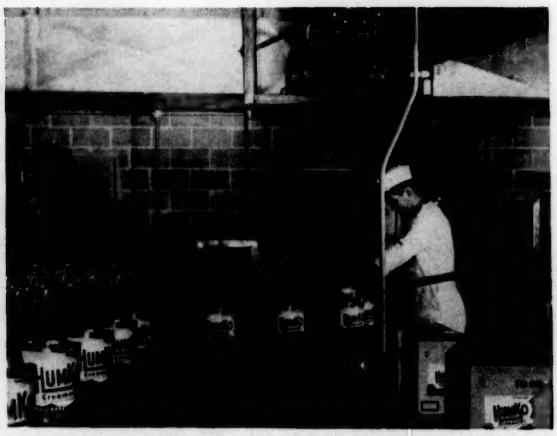
Raw edible oils are treated for the removal of impurities. Such impurities are centrifugally separated from the oils by this battery of centrifuges in the refinery. Refined oils are then water washed and vacuum dried. Following the refining stage the oil is next bleached, hydrogenated and deodorized. Finishing takes place in the Votators pictured above. These machines are closed, externally refrigerated cylinders equipped with rapidly revolving internal scraper blades. The liquid fat is rapidly chilled while being blended with nitrogen and air to a fine crystalline structure which causes its semi-solidification.



This battery of twin cylinder Votators provides cooling and whipping action which initiates finishing touches.



From Votating, the shortening moves to filling machines such as pictured here. Frank Hartman is the operator.



From filling, production moves to packaging with Donald Tolar performing the operations at this point. From packaging the product moves to tempering. Storage at controlled temperatures permit final solidification and proper crystal development.

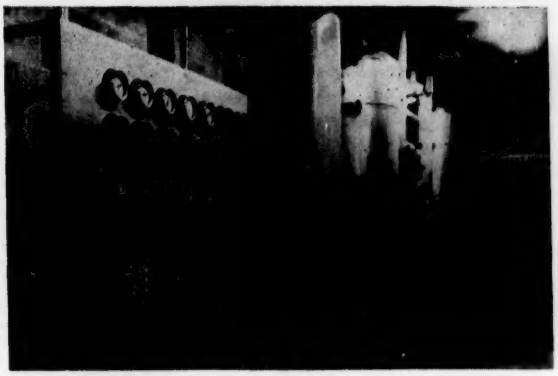
Power Conservation, Keynote Of HumKo Process Application

Heat and Refrigeration Process Twins—Team Up For HumKo

Above—Four A-frame boilers provide the steam heat required for refining, bleaching, hydrogenation and deodorization of crude edible oils. Operator is Martin Smith.

Top, right—One rotary and four multi-cylinder compressors working off a 3-level temperature and 2-stage compression refrigeration system, provide over 300-TR for process.

Right—Refrigeration control panel mounts the various temperature—pressure gages and mercury type pressure actuated switches for control of compressors and pumps. Pictured beyond are an ammonia still, high temperature high side inter-cooler or flash tank, a low temperature low side liquid cooled suction trap, and an intermediate intercooler.



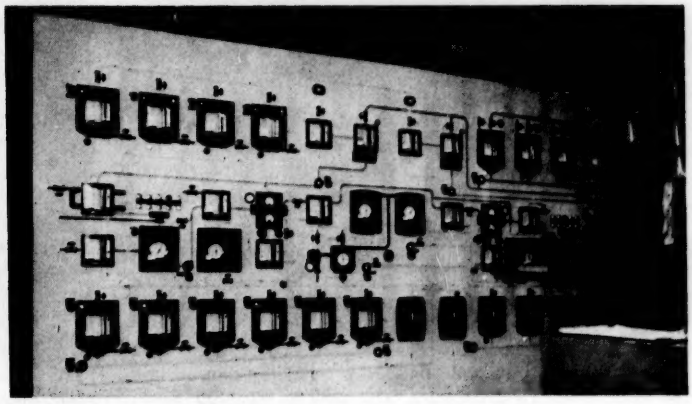
Quality Control Lab

Responsibility for high quality in the final product is in the hands of Chief Chemist William J. Howard and his staff. The laboratory makes continual tests of the material in process and directs any temperature or manufacturing procedure revisions that are needed to produce a specified type of shortening. The laboratory includes a completely equipped test kitchen. Shortening is tested in baked goods in order to keep track of the chemical balance and consistancy of the product as it would be used by a baker or housewife.

Chemist Howard believes that only through constant checking and testing can the quality of the shortening be controlled; and can the staff be certain that HumKo brand stands for highest quality in the mind of the user. Here too, is determined the fact that refrigeration plays an important part because these tests show whether or not the product is being affected by too low or too high a temperature during the finishing and tempering processes.

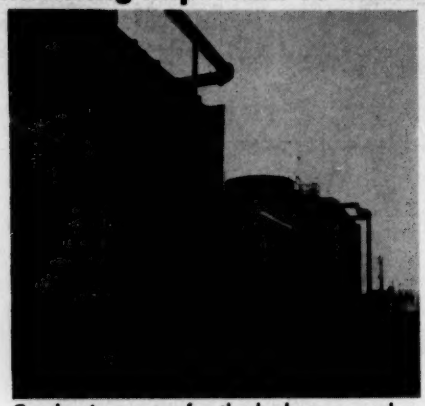
Recording Controllers Pinpoint Process Operations, Maintain Quality

Votation equipment in the finishing department is controlled by this pneumatic panel. Paul Maples checks finishing temperatures.



Refining operations are controlled and supervised from this central board. Arrangement of pressure-temperature, both visual and recording, controllers are in schematic flow patterns. Indicating lights show operations.

Condensing Important To Manufacturing Especially So In Industrial Food Processing



Condensing water for the hydrogen production facility is pictured in the foreground. In background is the twin cell refinery tower.

The refrigerating plant has its own battery of 100-ton evaporative condensers pictured here. Three such units and receiver are located just outside the machinery room. Refrigeration is by York equipment.

Push Button Operation

One of the features of HumKo's plant is its push button operation. Control of the processing in each major phase is from a control panel in that area of the plant. Mounted on each control panel is a graphic schematic diagram of the flow of the oil through that phase of the processing. In position on the diagram are off-on indicator lights, switches, meters, gauges and instruments for temperatures—pressure recording and operation control.

An observer at any panel can tell exactly what is happening physically to the oil being processed, and can regulate any necessary changes in procedure from the panel. It is the readings and/or recordings from the panels that keep the laboratory informed as to the state or treatment of the oil in process. The technique of these panel supervisory and control functions might well be adaptable to other areas of refrigeration or manufacturing.

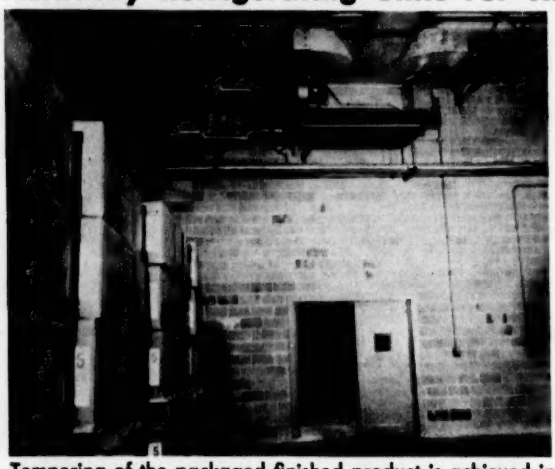
Other Cooling Systems

Final phase of manufacturing is a tempering or curing of the shortening in its packages, in a room of controlled temperature and humidity for an exact period of time. Walls are insulated and doors are pneumatically sealed so that a known and exact amount of refrigeration is obtained to perform the job. A small 25TR condensing unit provides the refrigeration for a ceiling-hung chilling system of blower coils. Having its own control panel, the system is engineered so that the small unit delivers the exact amount of refrigeration capacity that is needed.

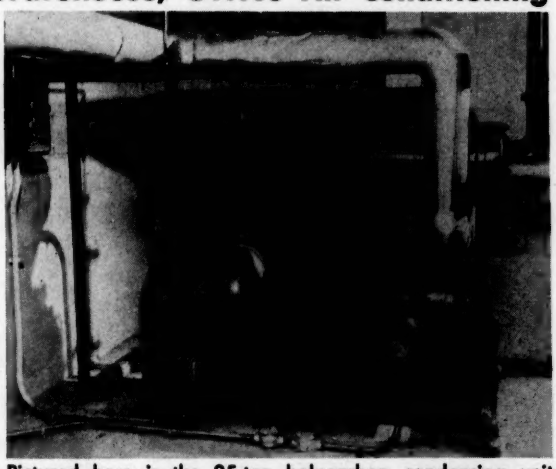
Air conditioning in the office building is provided by a 50-TR unit of the same type. Here, too, engineering efficiency is apparent as this system supplies cooling in hot weather and heating in cold weather. It is also housed in its own room and is equipped with its own control panel. The arrangement and location of the system components again shows forethought in equipment maintenance and sound isolation to prevent employee distraction.

HumKo is proud of their new plant, and justifiably so. They are a new industry in this community and are being welcomed warmly by the area residents. If the refrigeration and engineering arrangements in the plant are an indication or yardstick of production ability, the company certainly faces a rosy future.

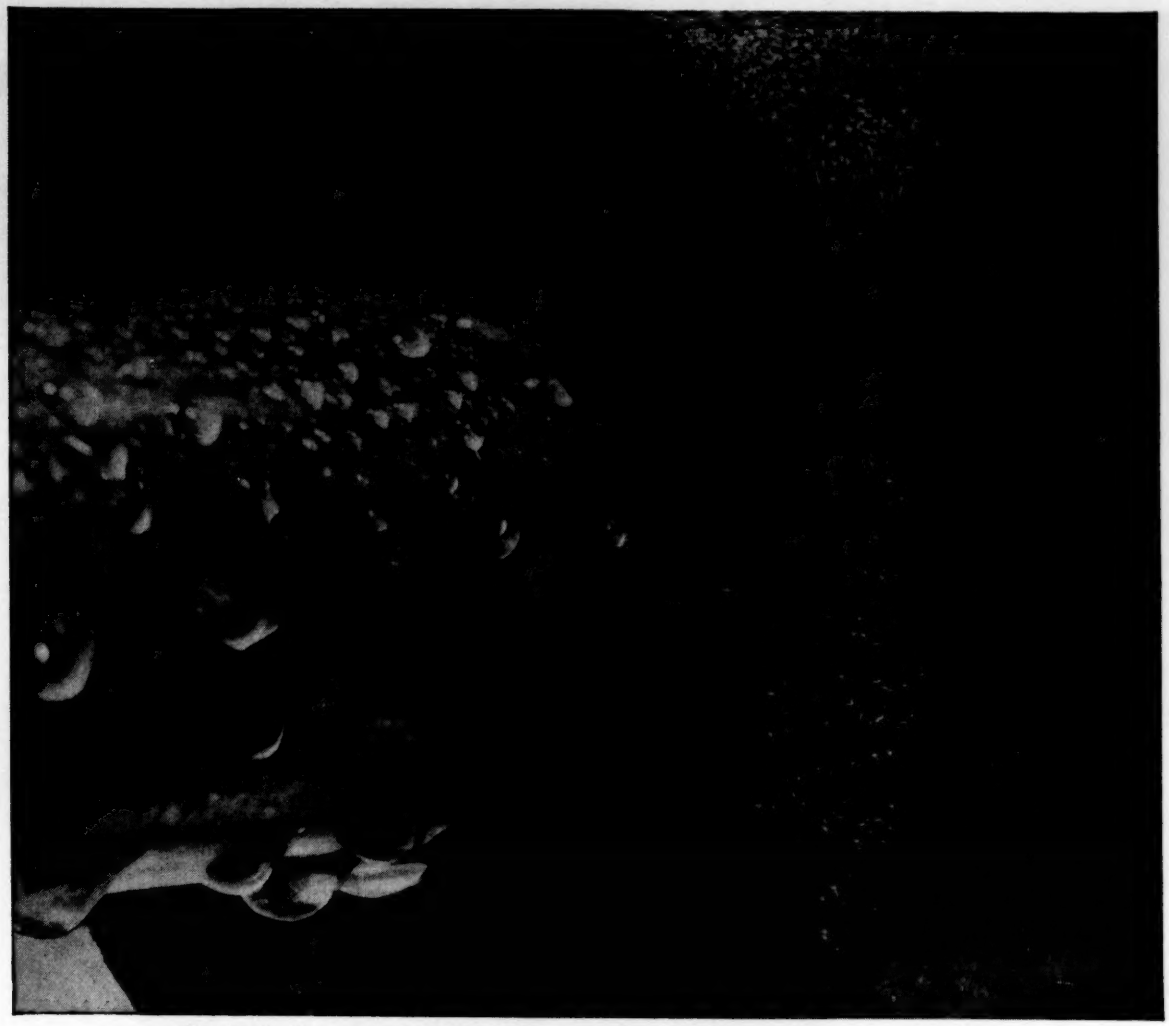
Auxiliary Refrigerating Units For The Warehouse, Office Air-Conditioning



Tempering of the packaged finished product is achieved in the warehouse. Pictured here is a ceiling mounted air-handling unit with distribution header. Units are mounted over aisle spaces for accessibility. Rooms are insulated and equipped with tight sealing doors.

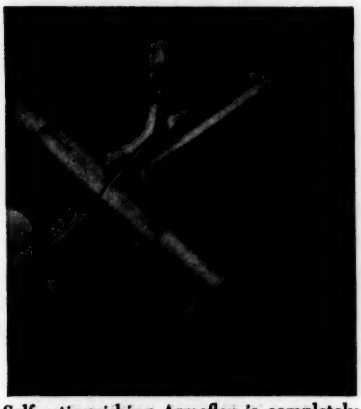


Pictured here is the 25-ton halocarbon condensing unit which supplies refrigeration for the tempering rooms. Unit is water-cooled, operated on thermostat control. A similar 50 TR unit (with the addition of a water chiller) is used for air conditioning plant offices.



The closed-cell structure of Armaflex seals out air and moisture, prevents dangerous condensation.

Stop harmful condensation at temperatures down to 0° F. with Armstrong Armaflex



Self-extinguishing Armaflex is completely safe to install before sweat fittings are made. Armaflex is clamped back from fitting, then connection is made.

With the new ¾" thick Armstrong Armaflex Pipe Covering, condensation can be stopped on fluid lines operating as low as 0° F. Armaflex is a highly efficient, flexible insulation with a k-factor of 0.28 at 75° F. mean temperature. Its closed-cell composition needs no separate vapor barrier, effectively seals out air and moisture. At all temperatures from 0° to 200° F., you can specify the economical amount* of Armaflex because it comes in a complete range of nominal wall thicknesses—⅜", ½", and the new ¾".

Faster, more economical jobs result from use of Armaflex. This insulation can cut labor costs by as much as 50%, compared with application costs for conventional, old-fashioned pipe coverings. Armaflex can be slipped over piping before connections are made or slit and snapped on. Joints are sealed with Armstrong 520 Adhesive. Fittings are easily insulated with miter-cut pieces of Armaflex.

* **Recommended Armaflex thicknesses** for various service conditions are listed in a free, descriptive booklet. For your copy, write to Armstrong Cork Company, 2202 Skye Drive, Lancaster, Pennsylvania.

Armstrong INSULATIONS

"Freon"-TF: SAFE SOLVENT

Non-Toxic, Non-Flammable, Non-Explosive Neutral Liquid

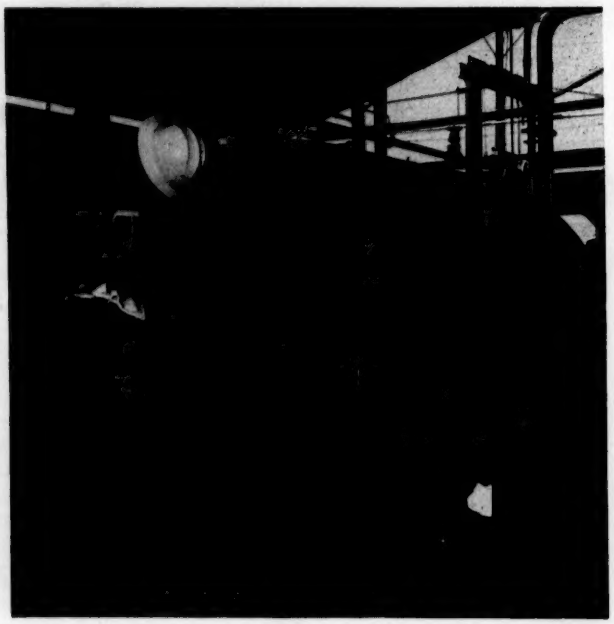
▶▶▶ LONG POWERFUL SERVICE given by electric motors, under sometimes the most adverse conditions is certainly a tribute to the skills and quality of workmanship of the electric motor industry. Although the basic design of motors has not changed in 40 years, refinement is steadily being made. New and better materials of construction are being utilized. Special types of insulation have been developed for specific applications.

Refrigeration Industry Employs Wide Variety

Electric motors are available in as many types and sizes as there are duties for them to perform. Some of these are of no interest other than academic to the practical refrigerating engineer. Many others are of more interest since the refrigeration industry employs a wide variety of types ranging from fractional hp to those delivering well over 100 hp.

TABLE I—VARIOUS GREASES SOLUBLE WITH "FREON" SOLVENTS

Grease Trade Name	Base	Source
Alvania	10% Lithium	Shell Oil Company
Cyprina	12% Lithium	Shell Oil Company
Strona HT1	20% Strontium	Union Oil of California
Hulbert #8	10% Silica	Hulbert Oil & Grease Co.
Stanomelt 321	11% Silica	Standard Oil of Indiana
Unoba #2	10% Barium and Lithium	Union Oil of California
Starfax #2	10% Sodium and 25% Calcium	Texas Oil Company
Dow Corning	Silicone	Dow Corning Corporation



Typical of large industrial motors which may be cleaned in place is this 600 hp drive at a chemical processing plant. Here inspection plates are being removed prior to cleaning.

If the proper motor, with the proper insulation, is selected for the proper application, that motor would be expected to have a long and useful life.

Unfortunately in all too many cases, this useful life expectancy is never reached. When a motor goes into service, it is immediately subject to accumulating oil, grease, and dirt on its windings. This soil builds up continuously and forms heat-insulating layers on the electrical insulation. Air circulation is not sufficient to sweep off the low K factor dead air trapped in the soil so the temperature of the motor and insulation rises. Motor operating temperature directly affects the life of the insulation and hence the life of the motor.

Predicting Insulation Life

Electrical insulation is rated by the AIEE into various classes which set a limitation on the maximum temperature allowable with a particular type of insulation. They have developed tests which are designed to forecast life at limiting temperatures.

Saums and Pendleton[1] in their paper on "Enameled Magnet Wire", suggest a formula for calculating the life of insulation as follows:

$$\text{Log } L = A + \frac{B}{T}$$

Where, L = life to failure in hours

T = absolute temperature in degrees K

A and B = constants for the insulation used

They also mention a "rule of thumb" which states that under aging conditions the life of insulation will be divided by two for every 10°C rise in aging temperature.

Soils Cause Inefficiency

Motors which run hot, run less efficiently, so that in addition to decreasing the useful life of the motors by not removing oil, grease, and other soil from the insulation, they will consume more power to do the same job. Electric motors produce heat as well as power. The more inefficient the motor the greater the amount of heat produced. The electricity used in the motor to produce lines of flux

FOR MOTOR MAINTENANCE

Permits Cleaning Large Electrical Apparatus In-Place

By JOHN H. DOWLING

and move the rotor is lost when it is converted from electrical energy to heat energy. Also, unless this heat is dissipated, the temperature within the motor will continue to rise until eventually the insulation is destroyed and the motor burns up.

Current requirements depend upon the load and, therefore, most motors are rated on the basis of a certain temperature rise when running fully loaded. Open motors are generally designed to run at a temperature rise of 72°F above the surrounding air temperature. Totally enclosed motors are generally rated at 99°F temperature rise.

Cleaning $ Equal Investment

Consider a motor which costs $1,000. If it is allowed to run without cleaning to the point where it becomes a fire hazard, it might be found that this point represented only half the useful life which the motor would have had, had it been kept clean. Therefore, a firm could spend up to $1,000 in cleaning this motor to obtain full life, and still be considerably ahead because the motor would have been running cooler and more efficiently.

Most of engineers and their managements recognize the value of keeping motors in top operating condition, but there are extenuating circumstances which make humans procrastinate with best of service ideas.

For example, in six months' time a motor winding may not seem to have a very great accumulation of soil. A year later it still may not look too bad, but the insidious point is that in time oily soils oxidize to form carbonaceous and varnish-like matter.

Six Months Soil Effect Simulated In Laboratory

Du Pont has simulated this condition in a laboratory to test the efficiency of "Freon"-TF as a motor cleaner.

Lab personnel took a small quantity of sweepings from a cement floor and mixed with 125 cc of Suniso 4G oil. Six standard steel corrosion strips then were dipped into the resulting mixture and placed flat in a Petri dish. Six standard copper corrosion strips were treated in a similar manner and placed in a Petri dish. A thin layer of the dirty oil was also placed in the dishes. The two dishes were then placed in an electric oven and maintained at a constant temperature of 248°F. for three weeks.

Dissolving Solvent

At the end of the three weeks' exposure at elevated temperature, the oil in the dish containing the steel strips had turned into a resinous black coke-like residue. The steel

A paper presented to the November 1958 convention of the National Association of Practical Refrigerating Engineers at Miami Beach, Florida.

TABLE II—VARIOUS OILS COMPLETELY MISCIBLE WITH "FREON" SOLVENTS

Oil	Manufacturer
Nujol	Plough, Inc.
Synjet Oil 15	Texas Company
Suniso 3G	Sun Oil Company
Amoco 90 wt. Gear Oil	American Oil Company
Amoco 30 wt. Motor Oil	American Oil Company
Texaco Aircraft Hydraulic Oil	Texas Company
Socony Mobile DTE Lube Oil	Socony Mobile Company
Northia #27	Shell Oil Company
Texaco Sultey B Cutting Oil	Texas Company
Clorafin 40	Hercules Powder Company
Versilube F-50	General Electric Company

Close-up of motor pictured on page 2. Note the soil lodged on and between windings. If motor housing were liquid type, it would not have been necessary to remove end-bells and motor could be run directly in the "Freon" TF

Fluorinated hydrocarbon solvents are supplied in sealed containers. Recommended pump is positive and exerts no pressure on the drum.

strips were covered on their bottom sides with this material. The top side of each strip was covered with a golden brown brittle varnish.

The oil in the dish containing the copper strips had turned into a viscous brownish-black tarry mass. The bottom side of each test trip was covered with this material while the top side was covered with a dark oily coke-like deposit.

Upon removal from the dishes, the strips were placed in jars of "Freon"-TF solvent and trichlorethylene for nine days. Based on visual observation of the test strips after removal from the solvent, it was apparent that the "Freon"-TF readily removed the oily, tarry components of the soil but did not dissolve the varnishes and carbonaceous deposits.

Trichlorethylene appeared to be a much better solvent for the varnish than the "Freon"-TF, particularly the varnish which had formed on the top side of the steel strip. Trichlorethylene however, was equally ineffective in removing carbonaceous deposits.

Solvent Reactions

These results were as expected:

1. There is no solvent which will dissolve carbon.
2. All chlorinated solvents will at least partially dissolve varnishes, but if they remove the varnish formed from the soil, they will also remove the electrical insulation varnish.

Practical Methods Reviewed

There has always existed a need for a practical method of cleaning motors, which would do a good cleaning job with maximum safety to personnel and yet not harm insulating varnishes and other insulating materials.

Methods used may be classified as follows:

1. Solvent cleaning
2. Abrasive cleaning
3. Combinations of both.

Solvent cleaning has, in general, been effective in removing soils but leaves much to be desired in safety and effect on materials of construction.

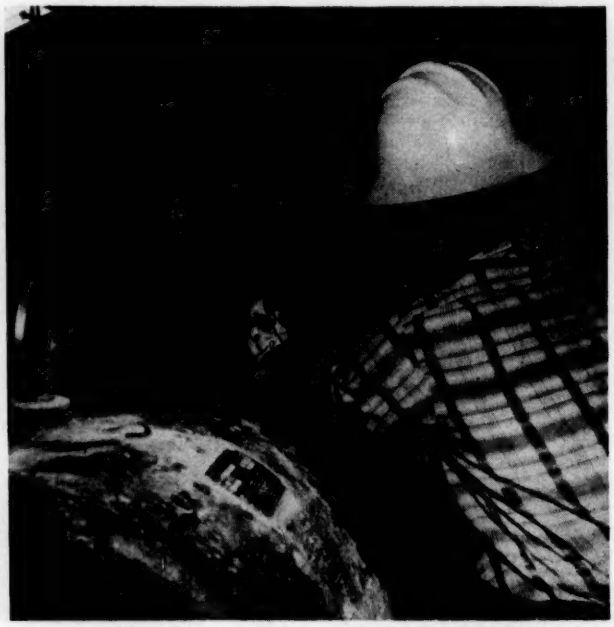
Chlorinated solvents, while non-flammable, are solvents for varnishes and have swelling effects on many insulating materials. As a class they are rather toxic.

Less Damaging Solvents Usually Highly Flammable

Hydrocarbons, such as naphtha, Stoddard solvent, etc., are less hazardous to materials of construction, having not much solvent action on varnishes and milder swelling effects on insulation. They are, however, flammable and even the high-flash materials are dangerous in spray applications. They also, in many cases, leave a high-boiling oil film which is ready to pick up contaminants from the air even immediately after cleaning.

Absorbent Materials Usually Abrasive

Abrasive cleaning such as found in the process which uses high velocity ground up corn cobs and similar material does a good cleaning job on certain types of soils but also, be-



The brush and wash method of solvent application is recommended. Soil encrusted windings are saturated and brushed when soil reaches fluid consistency. Final wash completes job.

cause of its abrasive action, at least partially removes insulation varnish. It is also difficult to clean recessed places sufficiently.

Steam Cleaning Adds Baking-Out Requirement

Steam cleaning works partially on the steam distillation principle and partially by abrasive action. It does not appear suitable for cleaning motors in place since the motor should be baked after steam cleaning.

Semi-Annual Cleansing Best Preventive Practice

Recognizing the difficulties involved, it is believed that a logical conclusion with regard to properly maintaining a motor, should be cleaning at regular intervals of approximately six months. Wash off the soil before it hardens to varnish-like materials!

It is possible to do this numerous times with a minimum amount of "Freon"-TF without affecting in any way the protective varnish coating of the electrical insulation. "Freon"-TF, being nontoxic and non-flammable, lends itself readily to be used for quick, easy cleaning of motors in place. Simple dismantling is all that is required in most "clean-in-place" operations.

Laboratory Research Cited

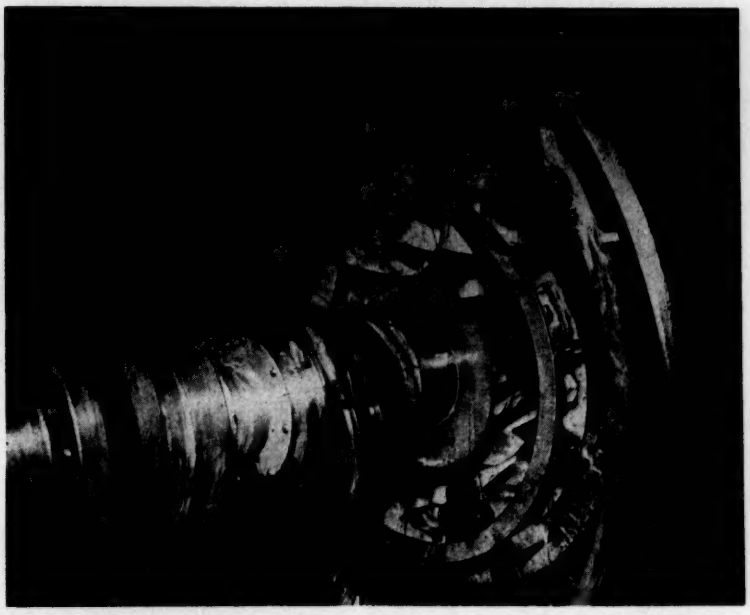
Other requirements for a motor cleaner are that it dissolve oil and grease but be essentially inert to electrical wire coatings. Tables I to V, in support of such qualifications, were prepared from experiments conducted at du Ponts' "Freon" Products Division laboratories.

Pump maintains pressure while spray gun delivers solid liquid stream. Air is not mixed with the solvent.

Soluble Greases Listed

Eight types of common industrial greases were evaluated for miscibility with the "Freon" solvents at room temperature. It was determined that either by adding grease to the "Freon" or "Freon" to the grease, each of the "Freon" solvents dissolved at least as much as its own weight of the lubricants shown in Table I. These greases were all that were tested. Based on these results, however, the majority of greases are expected to be soluble in "Freon" solvents.

Oils which are completely miscible with "Freon" TF at room temperature are listed in Table II. These oils were all that were tested, but based on these results, it would be expected that the great majority of oils would be completely miscible with "Freon" solvents.



This photo shows metal surfaces and coils of motor after removal of thick soils. Motor was cleaned completely in one day with $80 worth of solvent. Same job previously required cleaning cost alone of nearly $400.

Important Factors of Cleaning Methods Outlined

The method of applying "Freon"-TF to motor windings is very important. It should be applied in a liquid stream. It should not be applied combined with an air spray since it is quite volatile material and the solvent effect of the "Freon"-TF which is vaporized in air is lost.

One piece of equipment which has been found effective and practical is the Binks air driven Pogo pump (Model 41-8500). This pump fits into the bung of any standard drum. It is a reciprocating pump operated by compressed air. All of the pressure is developed in the pump and none in the drum. This develops adjustable liquid pressure in an attached hose line up to 100 psig.

TABLE III—SOLVENT EFFECT ON VARIOUS WIRE COATING MATERIALS

Materials completely immersed in the solvent at room temperature.*

Sample	Solvent	Contact Time	Effect on Sample
1. Bondar wire (cotton coating removed)	"Freon"-TF	24 hours	Not affected
2. Bondar wire (cotton coated with varnish)	"Freon"-TF	24 hours	Not affected
3. Insulating cloth (varnish coated)	"Freon"-TF	24 hours	Not affected
4. Paper insulation	"Freon"-TF	24 hours	Not affected
5. Formvar wire	"Freon"-TF	24 hours	Not affected
6. Silicone-treated glass and mica mat tape	"Freon"-TF	1 day	Not affected
7. Silicone-treated glass and mica mat tape	Naphtha	1 day	Complete removal of silicone varnish-materials separated
8. Silicone-treated glass and mica mat tape	Trichlorethylene	1 day	Complete removal of silicone varnish-materials separated
9. Silicone-treated glass and mica mat tape	Inhibited methyl chloroform	1 day	Complete removal of silicone varnish-materials separated
10. Silicone-treated glass and asbestos slot liner	"Freon"-TF	1 day	Not affected
11. Silicone-treated glass and asbestos slot liner	Trichlorethylene	1 day	Complete removal of silicone varnish-materials separated
12. Silicone-treated glass and asbestos slot liner	Inhibited methyl chloroform	1 day	Complete removal of silicone varnish-materials separated
13. Silicone-treated Class "H" motor coil	"Freon"-TF	1 day	Not affected
14. Silicone-treated Class "H" motor coil	Naphtha	1 day	Complete removal of silicone varnish from tape
15. Silicone-treated Class "H" motor coil	Trichlorethylene	1 day	Complete removal of silicone varnish from tape
16. Silicone-treated Class "H" motor coil	Inhibited methyl chloroform	1 day	Complete removal of silicone varnish from tape
17. Dow Corning 996 electric insulating varnish	"Freon"-TF	2 mins	Not affected
18. Dow Corning 996 electric insulating varnish	VM & P Naphtha	2 mins	Not affected
19. Dow Corning 996 electric insulating varnish	Inhibited methyl chloroform	2 mins	Varnish blistered
20. Dow Corning 997 electric insulating varnish	"Freon"-TF	6 mins	Not affected
21. Dow Corning 997 electric insulating varnish	Inhibited methyl chloroform	6 mins	Varnish blistered

The liquid "Freon"-TF is ejected from a Binks Co. Model 31 fluid gun equipped with a #0B138 fluid nozzle. High velocity liquid streams can be obtained with this equipment.

It is also possible to accomplish the same pumping effect by using a rotating vane pump such as Fisher Scientific Company pump (Model VW-1, Type 101) driven by electric motor such as General Electric universal (1/15 HP, 60 cycle, 5000 rpm, Type P).

Submerged Cleaning

In some cases, totally enclosed motors are so constructed or so modifiable that it is possible to contain "Freon"-TF in the housing with the liquid level covering part of the rotor. The motor can then be actually run in the "Freon" under no load conditions and exceptionally rapid and complete cleaning action is attainable. A solvent to be suitable for use in a cleaning method such as this must, of course, be harmless to insulation and varnishes, must be nonflammable, nontoxic, etc., but, in addition, must have suitable electrical properties.

Electrical Non-Conductors

"Freon" solvents are nonconductors of electricity and exhibit high relative dielectric strength. Use is made of these properties with the "Freon" compounds which are used as refrigerants[3]. For example, "Freon" compounds are used in hermetically sealed units where the motors are exposed for years to "Freon" as a vapor and liquid.

Compare solvents in regard to their electrical properties by examining their dielectric constants and resistivity. As seen in Table VI, the dielectric constant is higher for those solvents having hydrogen in the molecule, and conversely the resistivity decreases.

Cleaning Methods

When the soil on a motor is composed of wet oil and carbon, it is very easy to attain solubilizing action with "Freon". This reduces the viscosity of the oil and allows the soil to be directed to the motor sump, carrying insoluble particles along. Action of liquid stream alone is sufficient to accomplish cleaning.

Unfortunately, some motors have not been cleaned in years and, consequently, the oily soil has oxidized and caked into a dense mass on the winding. When this condition exists, it is necessary to loosen this soil by vigorously rubbing with short bristle

*First five samples were from a Westinghouse 40 hp motor. Samples 6 thru 16 were G.E. Co. materials on which specifications were not available.

brushes, at the same time applying a light stream of "Freon"-TF to the winding so that the soil is formed into a fluid paste[4]. This is done in small sections at a time. Once the paste is formed, it should be immediately washed off with a high velocity stream of "Freon". Where the motor is relatively small this, although time consuming, works quite well.

Related Safe Solvents

There are two other "Freon" solvents which have quite similar properties to "Freon"-TF. They are "Freon"-MF and "Freon"-BF. "Freon"MF boils at 75°F. so that extremely rapid evaporation does not make it practical to use by itself. However, it is a much less expensive material and blends of it with "Freon"-TF have worked well. It is commercially available in these blends. "Freon"-BF is quite a high boiling material, having a boiling point of 199°F. It cannot be used by itself since it has a freezing point in the vicinity of room temperature. Blends of "Freon"-BF with "Freon"-TF or "Freon"-MF are also commercially available.

Stubborn Cases

Sometimes the soils on motors have a high percentage of inorganic materials, or in some cases there is excess moisture or water present. This is a difficult motor cleaning problem since none of the solvents which could even remotely be considered for motor cleaning would dissolve and remove any of these materials, including the "Freon" solvents.

Flux Removing Blend

Du Pont has, however, developed a blend of "Freon" and specially denatured anhydrous ethanol[5] is capable of solving this problem.

This blend was primarily formulated as a cleaner to remove rosin solder flux from printed-circuit boards after complete assembly. Laboratory work has demonstrated it to be harmless to a great many insulating materials; it does not affect color codes, is nonflammable up to approximately 25% evaporation, and is of a low toxity.

This blend can dissolve up to 11% of its own weight of water. It has very recently been used to clean burned out hermetic motor compressors and appears to be applicable to cleaning many types of motors, where moisture, dirt, or inorganic salts in addition to oil, carbon and grease are present.

Large Hermetic Cleaning

An effective method for cleaning large burned-out hermetic refrigeration compressors has long been a problem in the industry. The present method used is to completely disassemble the compressor, hand clean individual parts with "Freon"-MF or nonrecommended cleaners such as carbon tetrachloride or trichlorethylene. Then reassemble, add oil and run a while, discharge the oil, add oil again for as many times as necessary (determined by physically examining the color of the oil).

When the compressor is returned to service, more oil changes are usually necessary and run as high as 8 to 10. With the cooperation of a large refrigeration compressor manufacturer, Du Pont conducted a test on a burned-out 60 hp compressor which was chock-full of oil, carbon, water and other burn-out products, following this practice:

1. Remove the burned-out motor stator and replace.
2. Add "Freon" printed-circuit cleaner to the completely assembled compressor until it is approximately one-half full.
3. Add 2 to 3 quarts of clean new refrigeration oil (depending on the size of the compressor).
4. Start and run the compressor at no load, with the cylinder heads off, for approximately 10 min.

(Continued on Page 23)

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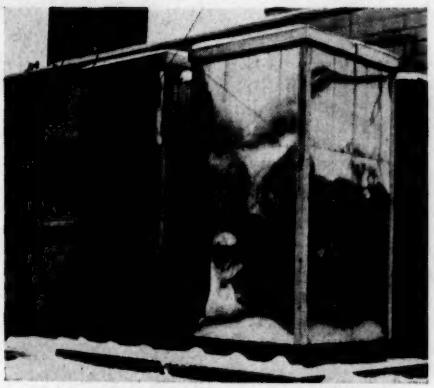

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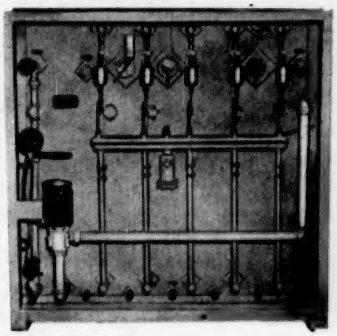
Front View of New PURE WATER COOLER (PATENTS PENDING)



(AT LEFT)

View of "King Zeero" E series Ice Builder installed outside of the Pet Milk Company plant at Evart, Michigan.

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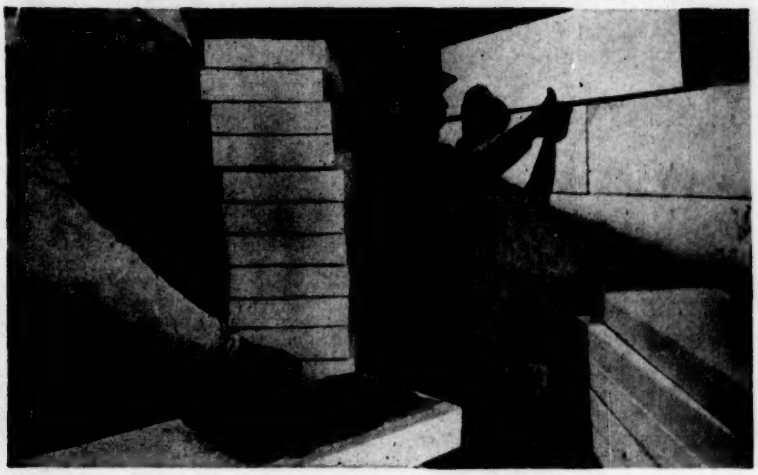

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TABLE IV—SEALED-TUBE TESTS ON WIRE INSULATION WITH THE "FREON" AND OTHER SOLVENTS—100 HOURS AT 130°F.

Solvent	Wire Coatings					
	Formvar	Bondar	Nylon	"Lecton"	Alkanex	"Beldol" Polyurethane
"Freon"-MF	Slight crazing; coating not softened; no extraction	No crazing; coating not softened, no extraction	No crazing; coating not softened; no extraction	No crazing; coating not softened; no extraction	No crazing; coating not softened; no extraction	No crazing; coating not softened; no extraction
"Freon"-BF	No crazing; coating not softened; no extraction	Results same as with "Freon"-MF	Results same as with "Freon"-MF	Results same as with "Freon"-MF	Results same as with "Freon"-MF	Results same as with "Freon"-MF
"Freon"-TF	No crazing; coating not softened; no extraction	Results same as with "Freon"-MF	Results same as with "Freon"-MF	Results same as with "Freon"-MF	Results same as with "Freon"-MF	Results same as with "Freon"-MF
Stoddard Solvent	No crazing; coating not softened; no extraction	Severe crazing; coating softened; no extraction	Slight crazing; coating not softened; no extraction	Results same as with "Freon"-MF	Results same as with "Freon"-MF	Moderate crazing; coating not softened; no extraction
Inhibited Methyl Chloroform	Severe crazing; coating softened during immersion in solvent, but withstood scrape test; no extraction	Severe crazing; coating not softened; no extraction	Slight crazing; coating not softened; no extraction	Results same as with "Freon"-MF	Moderate crazing; coating not softened; no extraction	Slight crazing; coating not softened; no extraction
Inhibited Trichlorethylene	No crazing; coating softened and scraped off easily; no extraction	No crazing; coating not softened; no extraction	Slight crazing; coating not softened; no extraction	Results same as with "Freon"-MF	Slight crazing; coating softened, easily scraped off; no extraction	Slight crazing; coating softened and easily removed; no extraction
Carbon Tetrachloride	Severe crazing; coating not softened; no extraction	Slight crazing; coating not softened; no extraction	Slight crazing; coating not softened; no extraction	Results same as with "Freon"-MF	Slight crazing; coating appears scaly; no extraction	Moderate crazing; coating not softened; no extraction

TABLE V—PHYSICAL PROPERTIES OF "FREON" FLUORINATED HYDROCARBON SOLVENTS

	"FREON"-MF	"FREON"-TF	"FREON"-BF
Chemical Formula	CCl_3F	$CCl_2F\text{-}CClF_2$	$CClF_2\text{-}CClF_2$
Molecular Weight	137.4	187.4	203.8
Boiling Point at One Atmosphere, °F	74.8	117.6	199.0
°C	23.8	47.6	92.8
Freezing Point, °F	−168.0	−31.0	79*
°C	−111.0	−35.0	26*
Critical Temperature, °F	388.4	417.4	532
°C	198.0	214.1	278
Critical Pressure, psia	635.0	495.0	500
atm.	43.2	33.7	34
Density at boiling point			
Liquid, lbs/gal	12.34	12.60	12.57
lbs/cu ft	92.31	94.29	94.03
grams/cc	1.479	1.510	1.506
Vapor (sat'd), lb/cu ft	0.3650	0.4619	0.438
grams/liter	5.847	7.399	7.02
Latent Heat of Vaporization at b.p., Btu/lb	78.31	63.12	41.0
cal/gram	43.51	35.07	22.8
Heat Capacity at 70°F (21.1°C), Btu/(lb)(°F) or cal/(gram)(°C)			
Liquid	0.205	0.213	—
Sat'd Vapor (Cp)	0.134	0.152	—
Thermal Conductivity at 70°F (21.1°C), Btu/(hr)(sq ft)(°F per ft)			
Liquid	0.0629	0.0537	—
Vapor	0.00473	0.00430	—
Viscosity at 70°F (21.1°C), Centipoises			
Liquid	0.438	0.694	1.21 (86°F)
Vapor	0.0108	0.0102	—
Refractive Index of Liquid at 79.7°F (26.5°C)	1.384	1.355	1.413 (77°F)
Surface Tension at 77°F (25°C), dynes/cm	19.0	19.0	23.0 (86°F)
Relative Dielectric Strength at 1 atm and 73°F (23°C), (nitrogen=1)	3.1	2.6 (0.4 atm)	—
Dielectric Constant			
Liquid at 86°F (30°C)	2.28	2.44	—
Vapor (0.5 atm) at 79°F (26°C)	1.0019	—	—
Solubility of water at 70°F (21.1°C), % by wt.	0.009	0.009	—
Solubility in water at saturation pressure and 70°F (21.1°C), % by wt.	0.14	0.017	0.013
Diffusivity in air at 77°F (25°C) and 1 atm, sq cm/sec	0.080	0.068	0.065
sq ft/hour	0.307	0.264	0.252

*The commercial grade may contain varying amounts of the isomer (CCl_2CClF_2) which has a melting point of about 40° C (104° F). The melting points of mixtures are between those of the pure isomers.

(Continued From Page 19)

5. Drain the compressor housing.
6. Repeat the procedure with a fresh charge of cleaner and oil.

The procedure outlined did a strikingly good cleaning job. The cost of cleaning and putting into condition a compressor of the size involved in this test would be approximately $1,000 with the old method. This new method will save several hundred dollars.

Conclusion

Answer to the problem of obtaining economical long life and peak efficiency from electric motors can be summed up in two words—Preventive Maintenance. Motors and generators should be cleaned once every six months. If this is done, the soils should still be in an oily condition and it will be a simple matter to flush this off along with carbon and other nonsoluble particles. The job can be done very quickly and a minimum amount of fluorinated halocarbon solvent would be required.

References:

[1]Saums, Harry L., Pendleton, W. W., "Enameled Magnet Wire", October 1957 ELECTRICAL MANUFACTURING, pp 131-148.

[2]For nontoxic and nonflammable properties of "Freon"-TF, see the Du Pont "Freon" Products Technical Bulletin, FS-1.

[3]Eisman, B. J., "How Electrical Properties of 'Freon' Compounds Affect Hermetic System's Insulation, April 1955, REFRIGERATING ENGINEERING, pp 61-66 and 133-139.

[4]Martin, Albert R., Fulton, George P., Dry Cleaning Technology and Theory, Textile Book Publishers, 1947, pp 26-38.

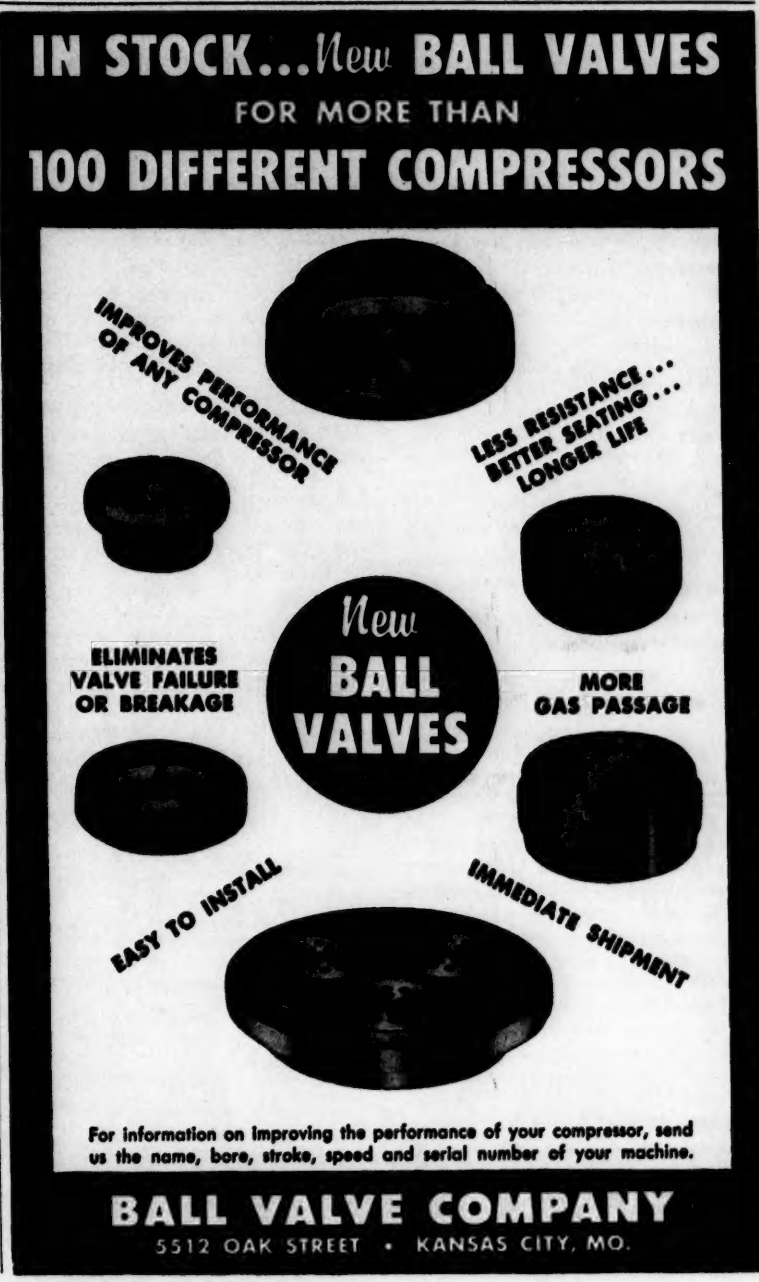
[5]Caution: This blend has not been as exhaustively tested on as many types of motor insulations as the 100% "Freon" solvents; so, whenever there is a doubtful case, its effect on the particular insulation involved should be tested.

John H. Dowling is a chemical engineer graduate of Northeastern University, Boston, Mass. (1941) Initially he worked for du Pont's Ammonia Dept., Experimental Station, Wilmington, Del., as a research chemical engineer for which he was awarded a Certificate of Merit by the U.S. Office of Scientific Research and Development for performances during World War II. Since then he has represented du Pont's Ammonia and Polychemicals Depts., Freon Products Division, and is presently technical assistant to the sales manager, Fluoro Solvents and Chemicals, Freon Products Division, Wilmington.

TABLE VI—ELECTRICAL PROPERTIES OF SELECTED SOLVENTS

Solvent	Formula	Resistivity (Megohm-cm)	Dielectric Constant
"Freon"-TF	$CCl_2F—CClF_2$	>12,000*	2.6
"Freon"-MF	CCl_3F	9,000	2.5
Carbon Tetrachloride	CCl_4	>12,000*	2.4
Trichlorethylene	$CHCl=CCl_2$	6,600	3.4 @ 61°F
Perchlorethylene	$CCl_2=CCl_2$	>12,000*	2.3
Chloroform	$CHCl_3$	3,000	5.6
Methylene Chloride	CH_2Cl_2	100	9.1
Methyl Chloroform	$CH_3—CCl_3$	-	6.0

Temperature 77°F. except where indicated otherwise
*The resistivity of these compounds was in excess of the resistivity which could be measured with instruments used in these experiments.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WALLACE M. SMITH Says:

PAY ATTENTION TO THE DETAILS

Facts and Figures Illustrate Financial Folly of Ignoring Them

Practical Engineers Have Moral Obligation to Recognize and Insist on Compliance

▶▶▶PURPOSE of this paper is to review some of the basic principles concerning refrigerants, moisture, oil, heat, acid, and illustrate by actual example how ignoring these principles proved to be a very expensive experience. There may not have been sufficient attention given to details.

Moisture is undoubtedly the number one enemy of refrigeration systems charged with one of the fluorinated hydrocarbons. Other refrigerants, such as ammonia (NH_3), sulfur dioxide (SO_2) or carbon dioxide (CO_2) may contain relatively large amounts of moisture. It is possible for the water to stay in these refrigerants and give no operational trouble.

Moisture is especially tough to deal with because it gets into a system so very easily, but it is so hard to get out. It causes more trouble than any other single contaminant.

What Moisture Can Do

At lower temperatures, moisture turns to ice. It will be found sticking up expansion valves, capillary tubes or evaporators, causing "freeze-ups". These in turn are sure to bring on further serious trouble and equipment failure.

Wallace M. Smith put together nearly 20 years of experience which eminently qualified him for this presentation. Prior to his present association he spent five years as a refrigeration service engineer, four years as a sales engineer in refrigeration and air conditioning, four years as a refrigeration and air conditioning contractor and six years as an instructor at Oklahoma City University in refrigeration, air conditioning and heating. He is employed by the General Chemical Division, Allied Chemical Corp., as a refrigeration technical serviceman in the Genetron section.

Information given in this paper is also available in the form of a strip film which was developed under the direction of Dr. W. O. Walker, Miami University.

At higher temperature moisture, as water, helps to form acids that cause corrosion and formation of sludges leading to equipment failures such as broken flapper valves and even copper plating.

Freeze-ups generally depend on three things:

(1) The amount of moisture involved
(2) The type of refrigerant, and
(3) The operating temperature

Ice separates from refrigerants when the amount of moisture exceeds that which the refrigerant can dissolve at the temperature in question, and this temperature is below the freezing point of water. A freeze-up can occur only if sufficient moisture is present and large ice particles are formed. Smaller particles pass through the system and melt at higher temperatures. The high solubility of water in ammonia, carbon dioxide and sulfur dioxide prevents these freeze-ups.

Wax Reacts Similarly

It should be noted that the separation of wax from oil can also produce symptoms of a freeze-up. These usually occur at much lower temperatures.

Freeze-ups, however, are not the only troubles from moisture. Corrosion can also occur from moisture. This means serious trouble because many times the effects of corrosion are not apparent until real damage has been done.

Corrosion Factors

Just how fast and furious the pace of corrosion becomes depends upon several factors:

(1) The amount of moisture
(2) The type of refrigerant
(3) The amount of heat
(4) The type of oil, and
(5) The type of material involved

For instance, moisture itself, in the form of water, can cause rust after a period of time. However, moisture plus the refrigerant equals much more serious corrosion trouble.

Combination of moisture and the fluorinated hydrocarbon refrigerants can result in the formation of hydrochloric and hydrofluoric acids that greatly increase corrosion of metals. With the exception of SO_2 systems, in which corrosive action is very rapid, most refrigerants require a much longer period for corrosive effects to be apparent. Heat increases the rate of corrosion by acids, and at higher temperatures, progress is more rapid, more acid being formed at a faster rate.

How Oil Forms Acids

Moisture isn't the only culprit in forming acids. The larger amounts are undoubtedly due to the interaction of the oil and refrigerant at elevated temperatures. Refrigerants of the halogen type react with oils at abnormal temperatures (350°F and above) to form acids in large quantities. Fortunately, this oil-refrigerant reaction does not occur in normally operating systems. Even over-heated oil alone will form limited quantities of acid.

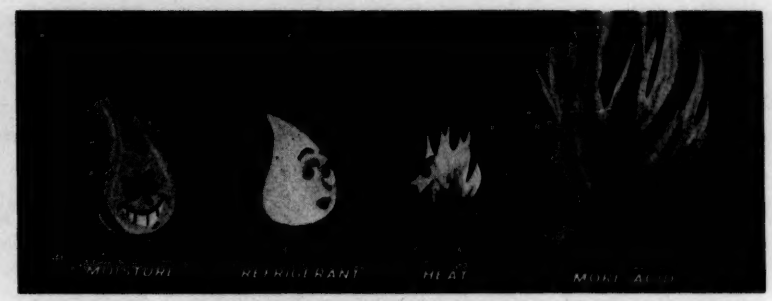
Corrosion becomes troublesome from the operating standpoint when the metallic surface is eaten away and a solid, detachable product is formed. This formation is commonly known as sludge. Sludges can exist as slimy liquids, fine powders, granular solids, or sticky solids.

Sludges can cause all kinds of troubles. They plug up expansion valves and capillary tubes. They can cause poor seating of flapper valves, and produce binding and freezing of bearings and pistons. Because they also usually contain acids, they corrode whatever they stick to, hastening the damage.

Importance of Dry Systems

Manufacturers of compressors, condensers, evaporators, tubing, valves, etc., are dehydrating equipment by evacuation, heating, passing inert gas

Demon moisture ultimately feasts on such important compressor components as flapper valves.



Combination of moisture and fluorinated hydrocarbon refrigerants, result in formation of hydrochloric and hydrofluoric acids which corrode metals rapidly. Heat increases rate of corrosion, forming more acids rapidly.

through the part, and other expensive processes to insure that no wet material is shipped to the field.

Refrigerant producers go to great lengths to provide dry gas to the trade. Almost 75% of the equipment in a modern plant for producing halogen type refrigerants is designed solely to dry and purify the refrigerant.

The great pains taken by manufacturers to provide dry refrigerants and refrigeration system component parts, must be matched in the field by care when installing and servicing units. Although many organizations have adequate facilities for drying smaller equipment in their shops, drying of large equipment in the field by the erection engineer is difficult and sometimes impossible. All field constructed equipment should have a most effective drier installed as part of the job.

Sources of Moisture

It is false economy to try to save money by re-using refrigerant taken from defective equipment. The chances are it has already picked up too much moisture and other impurities. In cases where the unit is shut down for a check-up and where no leaks are known to exist, the refrigerant may be re-used. **Always make sure** it is put in a clean, dry refrigerant cylinder. Marking cylinders "Clean Refrigerant" and "Used Refrigerant" is good practice.

The same holds true for re-using oils or filling with clean oil. Never use a dirty funnel or can, or leave the cap off the oil can. It is inviting dirt or moisture to enter.

Moisture is always present in the air, and it condenses on cold surfaces. Individual pieces, previously dry, can pick it up fast, especially when they are cold. A good example of this is tubing removed from low outside temperature to a warm machine room for installation. Unless allowed to warm up to room temperature before drying and installing it, enough moisture may be present to seriously damage the system. Of course, this condensation of moisture takes place when a low temperature line is broken in a high temperature room.

Not only human errors contribute to the entrance of moisture—there are mechanical causes, too. Leaks on the low side of a system operating below atmospheric pressure will suck in moisture laden air. Corrosion or mechanical failures in water cooled condensers can let large amounts of water enter the refrigerant circuit. As soon as the refrigerant leaks out, pressure forces water back into the equipment. Serious corrosion occurs and the equipment may be ruined unless the water is removed within a short time. Complete drying of the system is necessary.

Another source of moisture is through oxidation of oil. If air is present in a system, oxidation of oil may occur, especially if the temperature is high. This forms water.

It is apparent that careless installation or maintenance habits as well as mechanical failures can add moisture to a refrigeration system. What can be done about moisture once it is in the system? It has to be gotten out—and gotten out fast.

Methods of Moisture Control

First of all, heat should be applied to the unit to be dried. A temperature of 250 to 275°F is suitable. On large central station equipment this is usually very difficult. Often it is necessary to dry a component at a time and progressively work towards completion of the whole system. Because of the nature of refrigeration equipment, it is easier to remove moisture as a vapor. The higher the temperature, the faster water turns from a liquid to a gas.

Parts of the equipment, such as the metallic surfaces and any cotton or glass insulation, hold onto the water with great tenacity. For this reason, it becomes necessary to use the highest practical temperature to insure removal of the moisture. Care must be exercised, however, if insulating materials are easily damaged by high temperatures.

In addition to heat, a good vacuum must be provided to help insure complete removal. A vacuum pump capable of producing low pressures in the range of 50-100 microns should be employed.

Time is also a factor in proper drying. A minimum of four hours, or other time established by test, is required in moisture removal.

Dry nitrogen, carbon dioxide or refrigerant vapor is used to break the vacuum. This is very important, because these dry vapors sweep any moisture vapors out with it. In addition, a further drying effect is realized as the dry vapor sweeps past the walls, insulation, etc., where the moisture adheres to the pores in the surface.

Precautions With Solvents

Where equipment size prevents use of an oven for drying, each part may be flushed out with methanol or some other suitable solvent, and the excess solvent removed by heating carefully with a torch starting at one end of the equipment and working toward the other. The room should be ventilated well while working. Because of toxicity, carbon tetrachloride is not considered suitable as the solvent.

When this method is used, all the solvent must be removed and the equipment sealed from contact with moist air. A small charge of liquid Refrigerant 12 is sometimes added to the equipment and allowed to evaporate. This will carry off both water and methanol.

Use of Commercial Driers

Driers installed as a permanent part of the system are desirable. Activated alumina, anhydrous calcium sulfate and silica gel are some of the desiccants in current use. It is important to remember that driers pick up rather limited quantities of mois-

Corrosion eats away portions of metallic surfaces permitting the formation of a detachable product which becomes sludge.

Sludges are effective sealers and anti-lubricants. They plug up smaller passages and freeze up bearings and rings.

ture and may require replacement if any great quantity of moisture is present in the refrigerant.

Acid removal by desiccants has been advocated recently. It is true that all desiccants absorb acid to some degree. If the quantity of acid present is large, the desiccant will probably not pick it up. A system producing a large amount of acid is operating abnormally and is in serious trouble. In cases where there are prolonged reactions between the refrigerant and oil, due to high temperature, it is extremely improbable that the desiccant can do much real good. The safe procedure is to completely clean the system and restore it to normal operating condition.

Rules For Dry Systems

Using the above information, it is possible to draw some conclusions which are, in effect, basic rules:

A. All new systems should be properly evacuated and dehydrated before the system is charged.
B. All system components should be dry and clean.
C. All piping joints should be made under best possible conditions.
D. Adequate driers should be installed as part of every system.
D. Some method of determining moisture content of the refrigerant should be installed.
F. Any product used in the refrigerant circuit should be clean and dry.
G. Specifications and contract should include provisions for the above.

Example Worth Remembering

A recent trouble call involved a new refrigeration system installed as part of an expansion program in a mid-west manufacturer's plant. Because it illustrates so very well the costly results of violating some of the above rules, it is used here as an example of what occurs.

The system employs four reciprocating compressors located in a central equipment room. They are connected parallel to ten continuous tube evaporators located in large tanks. These tanks are arranged in forests of five. These forests are approximately 280 feet and 120 feet respectively removed from the equipment room. Each condensing unit has a shell and tube type condenser-receiver. The system is designed for Refrigerant 22.

The Author was called in after the system had been in operation about four months. While reading reports and work orders, observing the system and talking to interested parties, the following history was assembled.

The contract for this expansion was awarded to a large industrial mechanical contractor. This company sublet the refrigeration system to an air conditioning contractor in the vicinity of the plant.

Poor Piping Erection

A portion of the suction line was steel. This pipe was stored in an exposed location on the job site before installation. During this time rain and high humidity conditions prevailed. No attempt was made to clean up the steel pipe, except possibly a brushing out. The welding was done without measures to retard slag or oxidation inside the pipe.

Copper pipe was installed with 95-5 solder used on joints. Once again, no attempt to retard oxidation was made.

A pressure test was placed on the piping after the installation was completed. Afterwards, a vacuum was drawn and broken with nitrogen in an attempt to flush out moisture.

The system was charged and placed in operation. Within a few hours operational trouble was encountered due to inoperative expansion valves, solenoid valves and check valves in the refrigerant circuit.

This was attributed to moisture and a drier taken from another system was installed. This drier had enough capacity for about one seventh the amount of refrigerant required for this system. Later this drier was by-passed completely.

The system was operated by using steam heat to clear valve stoppage. This gave temporary relief.

Condenser Failure

About one month after start-up, one of the condenser-receiver tubes started to leak. This was not discovered until the charge was lost and considerable water was admitted to the system.

An attempt to remove the water by isolating the defective equipment was made. A vacuum was pulled and broken with dry nitrogen. No attempt was made to warm up remote sections of the system since all the tanks and lines were insulated.

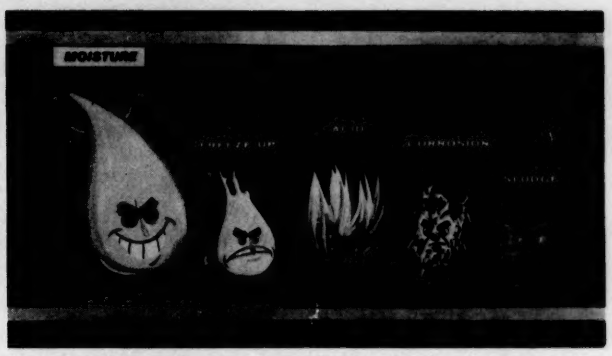
After the system was placed in operation again, the same freezing of valves prevented normal operation. In addition, the oil in each compressor body became very dirty. A fine silt-like brown substance clogged the oil circuit filter and cut out the condensing units on low oil pressure.

Frequent Oil Changes

It became necessary to change the oil in the compressor bodies very frequently. In addition to being quite expensive in replacement oil, this added to the down time on each compressor. Another effect was taking place inside the bearing journals and cylinder walls. The brown substance was iron oxide, and these small particles went wherever oil was pumped. This scarred highly finished surfaces wherever they were encountered.

While viewing liquid refrigerant in sight glasses installed just before each expansion valve, it was noted that flakes of black carbon-like solids were plainly visible.

Small refrigeration equipment is more easily and thoroughly dried than large systems.



Moisture and its offspring. Seven basic rules for their prevention are worth remembering, says the author.

An analysis of refrigerant, oil and sludge removed from one compressor body showed the refrigerant contained 240 ppm moisture. The safe level is far below this. In addition, an 8-lb cake of solid ice was removed from the header of a shell and tube evaporator. This ice formation had completely prevented the return of refrigerant vapors to the suction line.

The sludge contained flakes of iron and a large amount of iron oxide. The oil was black and had an odor.

Since no acid was present, it was suggested that the refrigerant be dried, filtered and used again.

It was recommended that the system be completely cleaned with chemical solvents and then thoroughly dehydrated.

It was also advised that adequate driers be installed, along with a device for indicating moisture content.

Suction line filters to prevent solids from entering the compressor bodies were also thought to be necessary.

The system was taken off the production line a short time later and completely overhauled. **Two new compressors and two completely rebuilt compressors were installed with four new condenser receivers.**

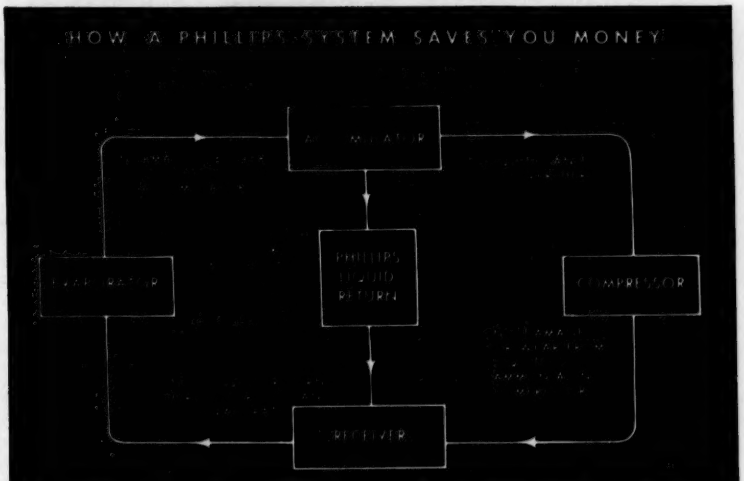
A pressure test revealed that many soldered connections were faulty. Several joints were re-made.

Proper Repairs-Replacements Exceed Original Contract

The total expenditures involved were staggering and exemplify why details are important. The system was installed for about $40,000. The total costs involved in maintenance and clean-up amounted to $45,000. This example should make it easily understood that in installation and maintenance of these halocarbon systems, it pays to **pay attention to the details.**

"SLOP-OVER" is not a necessary evil

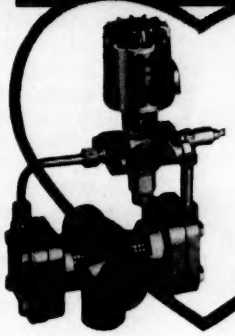
A PHILLIPS Liquid Ammonia Return System Will Protect Your Refrigeration Plant Automatically by Putting Slop-Over Where It Belongs — In the Receiver



A PHILLIPS Liquid Ammonia Return System gets liquid "slop-over" out of the accumulator in a refrigeration system almost as fast as the liquid arrives. The Phillips system sends the liquid back to the receiver quickly and automatically. Plant efficiency is increased, compressors are protected from wear and damage; operator time is saved; maintenance is decreased.

The Phillips system provides an extra dividend by speeding defrosting—it permits liquid to be drained quickly from coils to other parts of the system, to be just as quickly returned after defrosting.

Several types of systems are available, for gravity, injection-lift and pressure-lift operation in sizes up to 1,000 tons. Let a Phillips engineer help you select the right system. Send for Bulletin LRS-56.



THE HEART OF THE SYSTEM

This three-way valve, the heart of the Phillips system, helps keep it simple. The three-way valve teams up with the check valves and dump trap to keep liquid level down in the accumulator: The valve opens the line between the accumulator and Phillips liquid dump trap, to drain the accumulator; then lets high-side pressure through to empty the trap into the receiver. Process repeats automatically, as required.

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Air Conditioning Exhibition Held At Philadelphia

▶▶▶ FOURTEENTH International Heating and Air Conditioning Exposition sponsored by the American Society of Heating and Air Conditioning Engineers was held January 26 to 29 at Exhibition Hall, Philadelphia, Pennsylvania. Coincident with the exposition, ASHAE held its 65th Annual Meeting of the Society at Bellevue-Stratford Hotel. Arthur J. Hess, president, Hess-Greiner & Polland, Los Angeles, was elected president of the society.

Coincident with and at the exposition there were a number of announcements made of interest to the air conditioning industry. One was the arrangement whereby **Hubbell Corp.** controls are now available through **Sporlan Valve Co.** Three products of the Hubbell Corp. line which are being added to the Sporlan products by this move, are back pressure regulating valves, combination back pressure and stop valves, and large capacity solenoids.

Sporlan also celebrated its 25th anniversary in January. The present company was established in January 1934 and known originally as the Spoehrer-Lange Co.

A new district office was established in Philadelphia in January by the Insulation Division of **Armstrong Cork Co.** Lawrence P. Chubet is the manager of the new office.

R. E. (Dick) Kenney was appointed by **Recold Corp.** as their representative for air conditioning and refrigeration products in Minnesota. Kenney had been with the Refrigeration Engineering Co. in Montgomery.

Ben L. Williams, Jr., was named by the **York Division, Borg-Warner Corp.** as director of public relations, a newly created position. Harold S. Dybvik was named manager of Builder Sales for York, also a new position. The appointment emphasizes the importance that air conditioning firms are placing on builder relations with the inclusion of air conditioning as a standard appliance in modern homes.

New appointments were also announced by **Dole Refrigerating Co.**, Chicago. Gordon L. Timps, a native of Canada, was appointed to the newly created position of service manager and will work in the company's main office and factory in Chicago. Arthur E. Hodson has been designated Inspector-foreman of manufacturing facilities at Dole's Oakville, Ontario plant. Charles R. Huston has been appointed Senior Design Engineer on the transporation applications of Lektro-Cel.

Norman W. Kent was named sales promotion manager of **"Freon" Products Division, Du Pont,** a new position. Robert B. Sangston takes over Kent's position as manager of the division's central district office, Chicago. James Gay Gordon III, succeeded Sangston as sales supervisor, N.Y.C.

Armstrong Cork Co. was among the exhibitors, showing their Armalite and Armaflex lines. In addition to their heating line, **Armstrong Machine Works** also exhibited their new Humid-i-maker. **Bell & Gossett Co.** displayed their new refrigeration compressor.

Other exhibitors included **Calgon Co., Chemical Solvents, Highside Chemicals, Inc.,** exhibiting their lines of corrosion inhibiting and water treatment compounds, as well as other chemical products for the refrigeration plant.

Controls were featured by exhibits of **Alco Valve Co., Detroit Controls Corp., Henry Valve Co., Penn Controls, Ranco, Inc., Sporlan Valve Co. Wolverine Tube Division** was also exhibiting.

Components and packaged units were featured by **Dunham-Bush, Inc., Recold Corp., Tecumseh Products Co.** and **Vilter Manufacturing Co. Wagner Electric Co.** featured motors for air conditioning applications. **Johns-Manville Co.** featured a product line for the air conditioning industry and **York Division** introduced its new lithium bromide water vapor absorption refrigerating unit.

Recently Elected NAPRE Chapter Officers; Meeting Locations

10th Plant Maintenance and Engineering Conference Program

▶▶▶ TENTH PLANT MAINTENANCE and Engineer Conference which ran from January 26 to 29, featured 61 sessions and a show where 400 companies demonstrated equipment, services and accessory products. It was reported to be one of the largest and best attended of annual industrial expositions.

Sessions which were of interest to firms utilizing industrial refrigeration plants, included such topics as "Preventive Program for Control Instruments" and "Maintenance by Outside Contractors". "Counteracting Air and Water Pollution" was a repeat session of previous years, but nevertheless a very important one judging from the attendance. Other papers included such topics as "Economical Use of Electrical Power", "Why Safety Is Essential and How To Insure It, and Maintenance In Small Plants (up to 50 employees)".

The conference featured ten concurrent sessions on Monday and Tuesday, with Wednesday's sessions being devoted to a repeat of the earlier conferences. This permitted a wider choice of sessions for the visitor.

Exhibitors with products for the industrial refrigerating field included **Aeroquip Corp., Allis-Chalmers Manufacturing Co., American Air Filter Co. Inc., American Dryer Corp., Anchor Packing Co., Armstrong Machine Works, Barber-Colman Co., A. M. Byers Co., Change-O-Matic Corp., Clark Door Co. Inc.**

Also displaying merchandise was **Dean-Thermo-Panel Coil Div., Flexonics Corp., Fuller Co., Joy Manufacturing Co., Kenco Pump Division, Korfund Company, Inc., National Cylinder Gas Co., Owens-Corning Fiberglas Corp., Pennsalt Chemicals Corp., Pittsburgh Corning Corp., Rohm & Haas Co.** and **The Texas Co.**

Adhesive Products Dept., Swift & Co., among other products exhibited data on their **Adcote** Adhesive Finish, offering adhesive bulletins and information on trial orders.

The **"Freon" Products Div., E. I. du Pont de Nemours & Co.** introduced to the maintenance and plant engineers the new "Freon" line of safe solvents including "Freon" TF previously introduced at the NAPRE meeting in November. The development and application of this product is described on page 14 of this issue.

Other exhibitors included **Binks Manufacturing Co., Bowser, Inc., Garlock Packing Co.,** and **U. S. Department of Commerce.**

Book Review

Practical New Reference On Plant Operation & Management

PLANT ENGINEERING PRACTICE $18.50
F. W. DODGE CORPORATION

▶▶▶ COVERING every major area of plant engineering activity, a handbook was published in 1958 by F. W. Dodge Corp. called PLANT ENGINEERING PRACTICE. The work is entirely practical in nature as attested to by NAPRE's Educational Book Review Sub-Committee. M. E. Bell, then retiring as superintendent of engineering for a major brewery chain and now a consulting engineer, speaking for the committee stated that the more than 700 pages and 800-odd illustrations offer solutions to many daily problems that the plant engineer and his staff encounter. In the committee's opinion the book is not theoretical and is not a text book, but a very useful publication.

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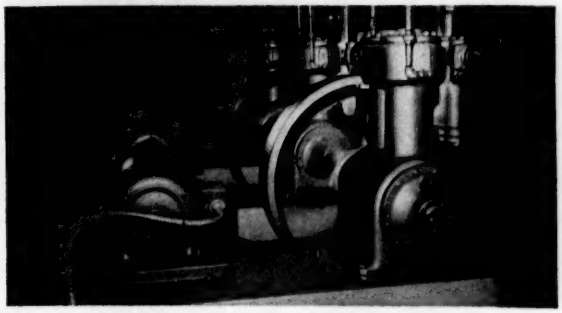

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Recently Elected NAPRE Chapter Officers; Meeting Locations

Chapter	President	Vice Presidents	Secretaries	Treasurer	Date and Place
Calif. No. 1 San Francisco	Robt. Lukaris Hamm Brewing Co.	H. W. Baker H. W. Baker Co. Stanley Andreasen Pac. Fruit Exp.	Leroy Etzel PFE (Retired)		2nd Tues. Pac. Scien. Bldg.
Calif. No. 2 Los Angeles	Guy R. King S. Monica College	L. H. Benedict Benedict Co. N. P. Desantis Adohr Milk Farms	Donald H. Byl Union Ice Co.	E. T. Quinn Pac. Fruit Exp.	1st & 3rd Wed. Terminal Club
Calif. No. 3 Sacramento	R. S. Skideel Pac. Fruit Exp.	M. A. Dockham Safeway Stores	James E. Moore State of Calif.		
Calif. No. 5 Colton	A. L. Long Ted Cox Welding	Roy C. Ashcom Pac. Fruit Exp.	J. E. Machut Pac. Fruit Exp.		2nd Wed. Sante Fe Plant
San Jose	Harry Vosburgh Modern Ice & C.S.	A. H. Mueller Santa Clara C.S.	J. M. DeBry Beall Refr. Co.		1st. Mon. Security Whse.
Stockton-Modesto	Manuel Lopez Service Contractor	H. Greenwood Swanson & Sons	Harry C. Dyer Pac. Fruit Exp.		
Greater Dade Co. Miami	Bert Cates Jackson Hosp.	Anthony J. Ruane Diplomat Hotel	C. W. Moneypenny Royal Castle Co.		2nd & 4th Wed. 3800 NW62nd St.
Greater Kansas City	V. W. Crocker Federal C.S.	Robert Clark Inland C.S.	John G. Muller Railways Ice & Ser.	John Schwab Central Packing	1st & 3rd Tues. Fed'l C.S. Bldg
Baton Rouge	L. E. Mitchell		Ross N. Stout La. State Univ.	V. F. Koegh La. Natl. Bank	3rd Thurs. As announced
Fruit Belt	John Pfauth Dwan's Home Canning	William Knowlton Sodus Fruit Exch. Lloyd Phillips Mich. Fruit Canners	Virgil Weaver Producers Creamery		2nd Thurs. Prod'rs' Creamery
Miss. No. 1 Jackson	Tommy Simmons Kremser-Oliver Co.	J. R. McClain Swift & Co.	D. G. Sanders Swift & Co.		1st & 3rd Mon. Heidelberg Hotel
Metropolitan New York	R. L. McCreery Ideal Elec. & Mfg.	Hugo M. Elstad Worthington Corp. John Pondish Montgomery Engrg.	Quaid Minich Seaboard Terminal		2nd & 4th Wed. Sheraton-McAlpin
Pittsburgh	E. G. Tessmer Pittsburgh Brew. Co.	J. C. Snyder Pittsburgh Brew. Co.	Otto P. Knoch Joseph Horne Co.		3rd Wed Pgh. Brewery
Southeastern Pa.	Charles Golin Lancaster Pack. Co.	R. V. Lefever P. Tassia Co.	S. M. Rambo Consumers Co.	M. W. Burkholder V. F. Weaver, Inc.	2nd & 4th Wed.
Tennessee No. 1 Memphis	H. M. Lentz, Sr. Diamond Ice Cr. Co.	W. D. Marbury Gaston Hospital E. S. Boland City Auditorium	C. A. Conley, Sr. Memphis C.S. Whse.		
Dallas	J. G. Swanson Alford Refr. Whse.	Virgil F. Young Alford Refr. Whse. Tom Weatherford Texas Meat & Prov.	A. C. Johnson U. S. Cold Stor. Geo. Stewart Kraft Foods	Jack Copeland Lorch Mfg. Co.	1st Mon. Alford Whse.
Washington No. 1 Seattle	E. J. Grainger Olympic Whse.	S. O. Kramer W. E. Stone & Co.	W. E. McCorkle Boeing Apl. Co.		3rd Thurs. Stewart Hotel
Washington No. 2 Tacoma	Ralph Williams Stokely-Van Camp	Robert Nelson Tacoma City Light	J. R. Bennett Tacoma Ice Co.		1st Wed. Tacoma Pub. Lib.
Olympia	F. Anderson Olympia Brew. Co.	Orville Ross Olympia Brew. Co.	L. Deschamps Olympia Brew. Co.	Bennie Berndson Olympia Brew. Co.	3rd Tues. Olympia Brew. Co.
Spokane	Richard Quam Sick's Rainier Brew.	C. H. Clapp Hygrade Food A. Mansfield Sacred Heart Hosp.	W. G. Erickson Sick's Rainier Brew. George Orman Sick's Spokane Brew.		1st Mon.-3rd Thurs. Engrs. Labor Hall
Yakima	Luther Stewart Warren Fruit	W. R. Stanley Norberg Fruit Co.	Elmer A. Toop Service Contractor		2nd & 4th Wed.
Green Bay	R. Vernimen Larsen Canning Co.	Myron Arnoldi Donald Welsing Miller-Rassmussen Co.	J. B. Schouten Bassett Refr. Co.	L. Zimmer Neenah Milk Prod's	G. B. Voc'l School

Roy T. Burns

NAPRE Chapter Elections; Burns Sets Conferences

▶▶▶ FROM THE PRESIDENT'S DESK, the monthly message from NAPRE's chief executive has been waived by that gentleman in favor of the tabulation at the left. One of the ideas of NAPRE's new president for a number of years has been a listing of chapter officers shortly after their election. The table shows officers elected by the chapters in December or January just past. President Burns plans a similar list in place of his message in either July or August, for those chapters which hold their elections in May and June.

L.A. Plans Education Meet

▶▶ TENTATIVELY set for the 1st or second week in May, is a regional educational conference which California Chapter No. 2, Los Angeles, will host. Current plans are to hold a conference on a Friday and Saturday. Sunday will be held open for local visiting and sightseeing. The conference is expected to attract representatives from all eight California chapters and members-at-large from five of the Southwestern states.

More Regional Conferences

▶ AN ITEM on the agenda of the executive committee meeting of NAPRE officers held at Chicago headquarters on Saturday and Sunday, January 10 and 11, was the encouragement of additional regional conferences. Chapters in the Northwest indicated they would hold a conference again this year as they have done in '57 and '58. The date and place has not been set. A North-Central regional conference is being competed for between the Pennsylvania chapters and the chapters situated around Lake Michigan.

Burns indicated that the president's page or a separate announcement next month may carry a statement as to where these conferences will be held, and give more specific dates and places for all three educational meetings.

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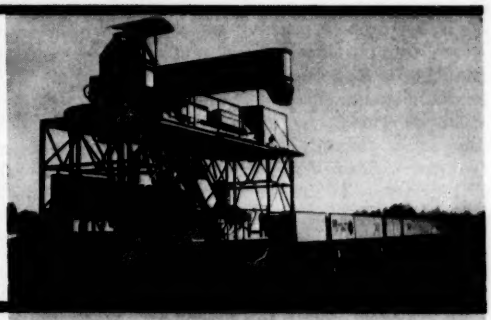
Great new improvements offered by Conveyco BUNKER ICING machines are producing tremendous savings in both initial installation and in operating costs for ice companies and railroads.

CONVEYCO machines with twin drum ice breakers reduce 300 lb. or 400 lb. blocks of ice to smaller bunker ice sizes with amazing uniformity and a minimum of wasteful fines. Fast two-man operation — one operator and helper — reduces costs. Write for complete money-saving story of "on-the-job performance" now.

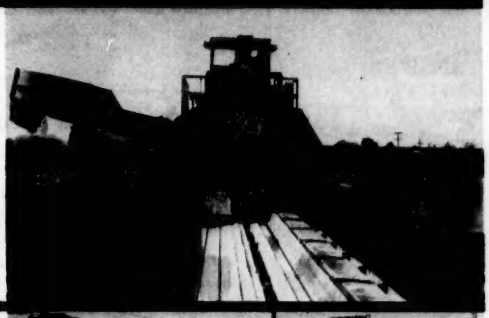
RAIL MOUNTED ICER

A complete self-propelled unit that ices refrigerator cars from an adjoining track. Carries own ice supply. Eliminates breaking up of long trains to ice cars. Saves time and money.



TWIN DRUM DOCK ICER

A fast two-man machine with automatic salting unit that ices and salts bunkers simultaneously. Ice is delivered to both hatches of a bunker at same time. Requires lighter dock construction than any other comparable machine — also is faster and more efficient.



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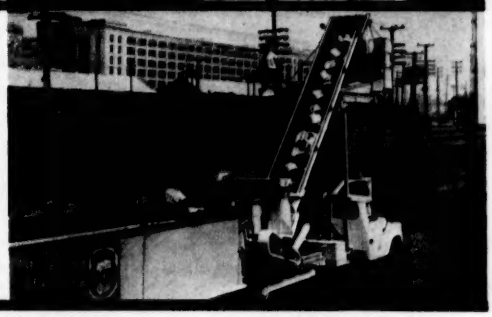

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NAPRE QUESTION BOX

HAVE A QUESTION? Address it to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif. Answers appear monthly in this department on problems forwarded by NAPRE members. Comments from all readers welcomed.

H. P. Hayes

Wiring Hookups For New Motor Voltages

QUESTION: We have a 175 hp synchronous direct drive motor rewound from 2-phase to 3-phase. Only name plates on the machine read "175 hp, 225 rpm, 2300 volts" and "rewound to operate on 4160 volt, 3-phase". The motor has no identification for 3-phase connections but six leads are provided. What method can I take for checking these leads for 4160-v and type connection?

Some years ago I worked in a steel mill electric shop where we changed 220/440-volt motors to 208-volt service. There we shoved six leads back in the stator and used the 220-v leads for 208-v. What is the difference of power consumption in that case, and what would be the loss in torque?—R.P.E., San Antonio.

ANSWER: Experienced electric service shop personnel seem to be in agreement that there is error in nameplates attached to the subject motor. For example:

"I'd like to see that 2-phase synchronous motor that was rewound for 3-phase at 4160-volts. There must be a mistake. The rewinder surely doesn't mean that! It would certainly be a curiosity!

Insulation Most Important

"It is quite possible that an experienced motor man could identify the leads readily. Older motors had no terminal boxes and leads were brought out through porcelain or fibre blocks in an orderly fashion. Whether it is Star or Delta has no significance at that voltage; insulation is the most important thing.

"There is no short cut for testing motors where all markings are lost or destroyed. In these cases the motor would have to be opened up and the Star or Delta taps located. After these points are located, continuity testing will determine the position of the phase grouping.

"In using the most common Star or Delta connected motors on voltages other than name plate reading, such as 220-volt motors on 208-volt circuit, little difference is noted. For most motors of a given horsepower rating and with equal insulation value, the difference between a 220-volt and a 208-volt motor amounts to only a few turns of wire per coil. In some instances, a change in the size of the coil wire is made."

Rewinding Is For Experts

Another reply read like this:

"Rewinding motors requires more data than a rating shield provides. General rules cannot be given as each machine is designed in a different way notwithstanding it is one built for the same voltage.

Poor Practice

"Shoving leads back in order to change a 220-volt motor into a 208-volt motor is poor practice. It is wasting money for nothing. A 220-volt motor can be used at 208-volts with a slight loss in its maximum torque (about 12%). At rated power output the stator current will be about 5% higher than the rated current on the nameplate. This causes a little extra heat loss but it should not do any harm to the motor."

Follow Manufacturer's Data

Here's what the first party wrote about 208- and 220-volt swaps:

"When putting a 220-volt motor on a 208-volt line, the motor will have less starting torque, it will heat up slightly more and the current rating will be higher at a given horsepower. This sometimes necessitates a higher rating on the protective device. This can easily be determined with a good ammeter. Many of the new motors are now stamped Suitable For Use On 208-Volts".

Owner of a Vacaville Electric Service Shop, A. H. Dietz, recommended some books on the subject:

"I personally use motor bulletins published and generally given free for the asking by most manufacturers. In addition, I use and recommend these books published by McGraw-Hill Book Co.: 'Connecting Induction Motors' by Dudley, 'Troubles of Electrical Equipment' by Stafford, 'Fractional Horsepower Electric Motors' by Veinot. There are many more but these are especially good."

With respect to your 175 hp motor, it seems that the original nameplate data are incorrect. We suggest you contact a reliable motor repair shop in your city, preferably one which has had wide experience with motors of the larger manufacturers.

—Jas. M. McGrath.

Modulating BP Valves

QUESTION: "Proper Refrigeration Increases Meat Profits" by D. D. Wile, January '58, page 31, IR, quotes the results of tests in which the modulating type of back pressure valve was used. This valve increased the back pressure at which the evaporator worked according to air temperature in the room. We in Australia are not acquainted with this sort of valve but feel it has a distinct usefulness. Who supplies this equipment? And upon what principle do these valves function?—J.B.B., Sydney.

ANSWER: These valves are of the evaporator pressure regulating type with a modulating motor to change the spring tension; the modulating motor being actuated by a room thermostat. The connection between the thermostat and the modulating motor is generally by means of an electric potentiometer circuit, although they may also be by means of a pneumatic system. Such valves are manufactured by several companies, including Refrigerating Specialties Co., Chicago, Hubbell Corp., Mundelein, Ill., and Alco Valve Co., St. Louis.

—D.D.W., Los Angeles.

NEW INQUIRIES of the QUESTION BOX

Holding Humidity Down With Indirect Refrigeration

QUESTION: On carload of ice which G. S. A. in his question on "Material Heats" in the September issue, wasted, could have been used very readily by this writer not too long ago. Contrary to usual practice, we were required to store a product at less than 50 rh, at a temperature of 36 to 38 F. Like G. S. A., I had some obsolete buildings only I was more fortunate in the fact that they were cooler storage rooms. I also had some old brine pipe coils but no more refrigerating plant. I didn't overcome my humidity problem, the merchandise in cans rusted, and we took a loss.

I have often thought of what I would do again in such an event, using a portable pump and a water ice refrigerant. Would someone care to check me by outlining steps to be taken, to accomplish the rh and temperature requirements if the room size is given, number of lineal feet and size of pipe, and the horsepower or gpm of the pump? The product was precooled when it was delivered and we were to hold it at these conditions in the field.
—J. A. H., Los Angeles.

Data Sought On Ammonia Safety

QUESTION: Where can literature be found on ammonia systems exploding, etc., and what the probable causes were? Also, if you have anything on the safety features that should be installed in a refrigerated warehouse and its system, where ammonia is used as the refrigerant?—A. G., Okinawa.

Designating Refrigerants By Chemical Compound Expressions

QUESTION: Our refrigerating system uses Refrigerant 113. In the compressor manual it is described as trichlorotrifluorethane (CCl_2F-$CClF_2$). Guy King's Table 9 in his paper "New Refrigerants", 1957 NAPRE Operating Data Book, shows the same gas to have a chemical formula of $C_2Cl_3F_3$. I presume either way to write it is correct but I would like to know why one author expresses the formula one way, and another author a longer more complicated expression.—R.L.F., Chicago.

Recurring Compressor Valve Troubles

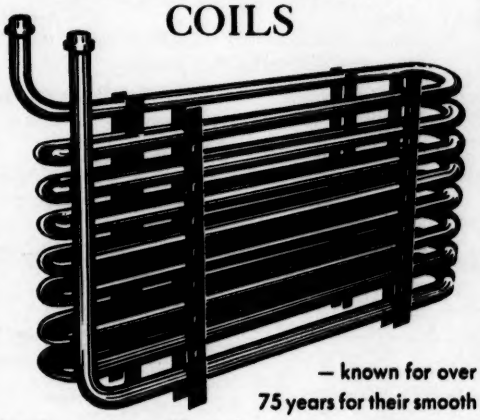
QUESTION: During the past season we had more valve troubles than in any previous year. We are using the compressor manufacturer's own valves in both high-stage compressors and boosters.

The boosters were equipped with ring plate valves when new. Approximately five years ago we removed the poppet type suction valve from the high-stage compressors and installed a new valve by the machine manufacturer, which is a ring plate assembly. The discharge valves were originally the ring plate type.

At first we had trouble with the center rivet breaking, but now the manufacturer has overcome that problem. According to them, it had something to do with improper temper of the rivets. Now our trouble seems to be with sudden changes in gas temperature, resulting in broken plates.—C.S. and R.V.P., Pa.

NATIONAL QUALITY

REFRIGERATION COILS



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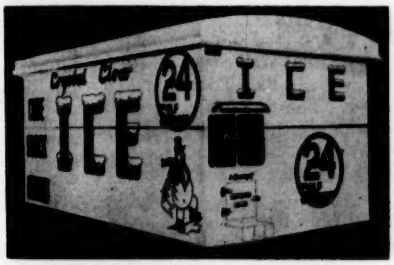

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More Sales + More Storage + Less Cost + Less Servicing
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- These new vendors are now made in lengths up to 20' which will vend 268-10# bags plus 132-25# blocks out of the same delivery door, (400 Sales).
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- Radical invention, trouble free, more storage space by design, lower operational cost.

NEW LOW COST 6' x 8' station vends 110-10# packages, or the "Junior", 3' x 7' station vends 90-10# packages using the new multi screw vendor.
ILLUSTRATED 9' x 16' Station vends 168-10# bags and 86-25# block.

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Industry Meetings

Poultry Fact Finding — **Feb. 13-15**
INSTITUTE OF AMERICAN POULTRY INDUSTRIES
Municipal Auditorium, Kansas City, Mo.

Delta Ice Manufacturing — **Feb. 22-24**
DELTA STATES ICE ASSOCIATION
Buena Vista Hotel, Biloxi, Miss.

O-M-I Ice Making — **Feb. 22-24**
OHIO, MICH., IND. ASSOCIATIONS (Jointly)
Netherland Hilton Hotel, Cincinnati

Frozen Food Packing — **Mar. 1-5**
NATIONAL ASSN. OF FROZEN FOOD PACKERS
Conrad Hilton Hotel, Chicago

No. Car. Ice Manufacturing — **Mar. 15-17**
NORTH CAROLINA ICE ASSN.
Washington Duke Hotel, Durham

Corrosion Exhibition — **Mar. 16-20**
NATIONAL ASSN. OF CORROSION ENGINEERS
Sherman Hotel, Chicago, Ill.

Power Conference — **Mar. 31-Apr. 2**
ILLINOIS INSTITUTE OF TECHNOLOGY
Hotel Sherman, Chicago, Ill.

Northwest Ice Making — **Mar. 19-20**
NORTHWEST ASSOCIATION OF ICE INDUSTRIES
Vancouver, B.C.

Southern & Georgia Ice Mfg. — **Mar. 25-26**
SOUTHERN ICE EXCHANGE AND GEORGIA ICE MFG. ASS'N
Biltmore Hotel, Atlanta

Refrigeration Research — **Apr. 2-5**
THE REFRIGERATION RESEARCH FOUNDATION
Statler-Hilton, Washington, D.C.

Refrigerated Warehousing — **Apr. 5-9**
NATIONAL ASSOCIATION OF REFRIGERATED WAREHOUSES, INC.
Statler-Hilton, Washington, D.C.

Meat Packing — **Apr. 16-19**
NATIONAL INDEPENDENT MEAT PACKERS ASSN.
Palmer House, Chicago

Mechanical Contracting — **Apr. 28-May 1**
MECHANICAL CONTRACTORS ASSN. OF AMERICA
Shoreham Hotel, Washington, D.C.

Air Cond'g & Refrig'n — **May 3-6**
AIR-CONDITIONING AND REFRIGERATION INSTITUTE
The Homestead, Hot Springs, Va.

Fire Protection — **May 25-29**
NATIONAL FIRE PROTECTION ASSN.
Atlantic City, N.J.

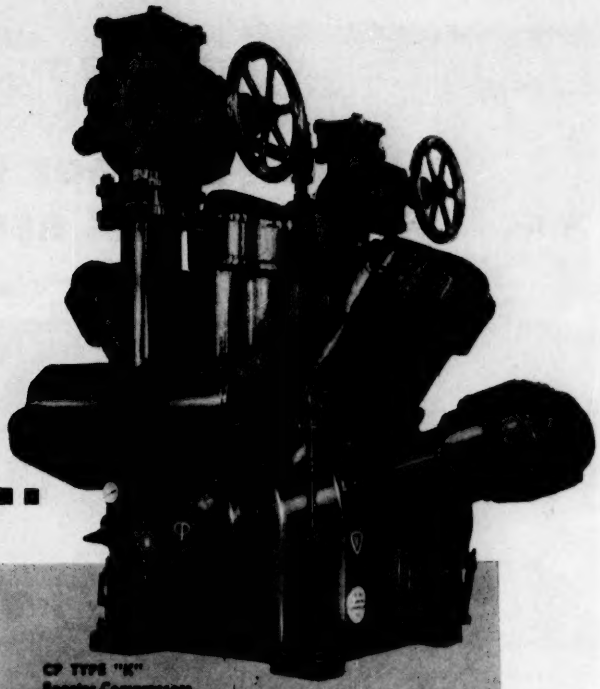
Heat'g & Air Cond'g — **Jun. 7-11**
AMERICAN SOCIETY OF HEATING AND AIR CONDITIONING ENGINEERS
Vancouver, B.C., Canada

Materials Testing — **Jun. 21-26**
AMERICAN SOCIETY FOR TESTING MATERIALS
Chalfonte-Haddon Hall, Atlantic City, N.J.

Refrig'n & Air-Cond'g. — **Jun. 22-24**
AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
Lake Placid Club, Lake Placid, N.Y.

Air-Cond'g & Refrig'n Exposition — **Nov. 2-5**
11TH EXPOSITION OF THE AIR-CONDITIONING AND REFRIGERATION INDUSTRY
Convention Hall, Atlantic City, N.J.

Any way you look at it...



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compact, efficient designs save valuable space

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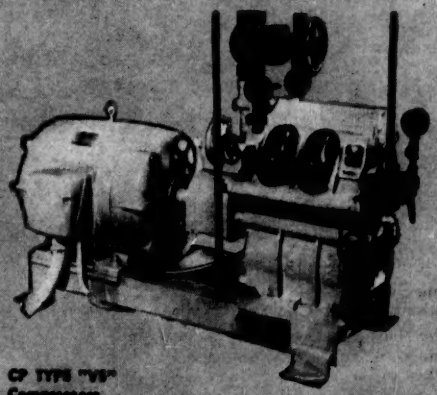
4, 6 and 10 cylinder models, from 10 to 120 tons capacity*



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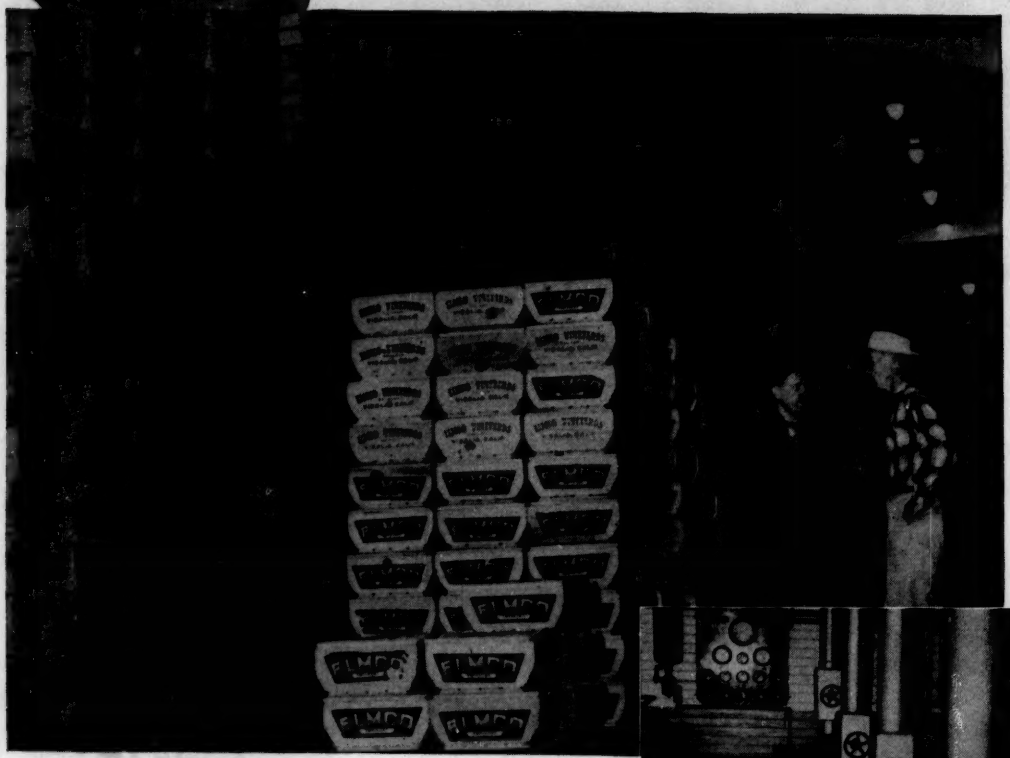
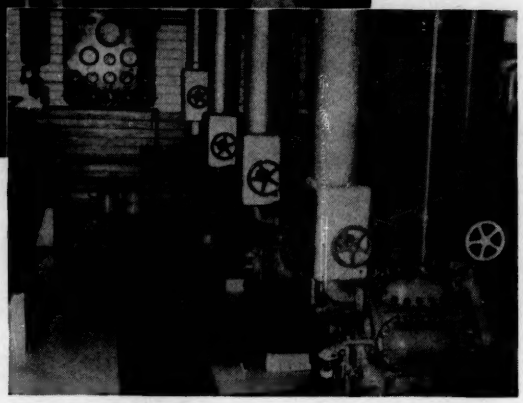
Look Inside THE WORLD'S LARGEST GRAPE STORAGE WAREHOUSE FOR YORK REFRIGERATION EFFICIENCY





Four 60 hp York VW Compressors precision-cool Elmco's huge grape storage warehouse. 78,000 feet of 1¼ inch steel coils circulate coolant to protect grapes waiting shipment.

Five grape storage rooms, totalling more than 780,000 cubic feet, are York-refrigerated at the Elmco Cold Storage Company, Porterville, Calif.

Elmco...just as other food storage plants and processors have...chose York Refrigeration for installation economy, operating economy, and the product engineering that gives York equipment a longer life with fewer maintenance problems.

So be right...right from the first...and ask your consulting engineer to check the facts about YORK refrigeration systems. They're tailored installations that cost no more. And full details are available simply by writing to York Corporation, York, Pa.

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Merchants Establishes NY Frozen Food Center

▶▶▶ SECAUCUS, New Jersey, is to be the site of a Port of New York frozen food center it was announced late in 1958 by Merchants Refrigerating Co. Although a refrigerated warehouse for the storage of all perishables is planned, the facilities are being constructed primarily as a center for frozen food distribution and production of prepared frozen foods. Merchants, through its Frozen Food Service Division and its subsidiary, Howell Trucking Co. Inc. provides a complete frozen food order selection and retail store delivery service.

Decentralized Location

Initial construction calls for 200,000 sq. ft. refrigerated warehouse, one of the first completely new refrigerated facilities for the New York Port area in the past 30 years. Merchants practice has been to dispose of older facilities as new ones are put in operation. According to officers of Merchants emphasis at Secaucus, as in other areas, will be smaller facilities geared to the rapid movement of frozen products, rather than larger buildings in downtown areas.

Wisconsin Also Delivers

▶▶▶ INAUGURATION of a new LTL trucking service for frozen foods to cities in central Wisconsin has been announced by Philip G. Kuehn, President, Wisconsin Cold Storage Co. Deliveries are being made in heavily insulated, mechanically refrigerated trucks held at zero or lower temperatures at all times.

New Cold Storage Firm Incorporated in Arkansas

▶▶▶ FREZ N STORE, Inc., an authorized $1 million dollar stock company was incorporated in Arkansas in mid-January. Rolland Ensley, Springdale, is listed as the firm's resident agent and an incorporator. Other incorporators are Harvey Jones, Luther George, Eugene George, Berlin Bilbrey and G. H. Tweedy of Springdale, and W. K. Ward of Fort Smith.

The company has been authorized to act as a general cold and dry common warehouse agency, to manufacture and sell ice, to manufacture and sell carbonated water, to build and sell refrigerated cars, refrigerated trucks, to grow and sell produce, etc. The plant will be constructed in Springdale on the Frisco Railroad and a 30,000 sq. ft. building was started on February 1.

ECONOMIZE!
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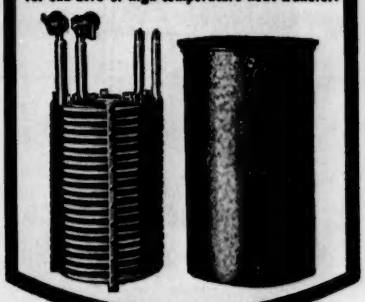
PIPE BENDS AND COILS
FOR REFRIGERATION

Rempe Shell and Coil Assembly
for sub-zero or high temperature heat transfer.



In Rempe Coils you get Top Engineering and Quality Construction — the best in Refrigeration Equipment for long-life and low maintenance.
For Ammonia or Freon. All materials — Stainless Steel, Copper, Steel.

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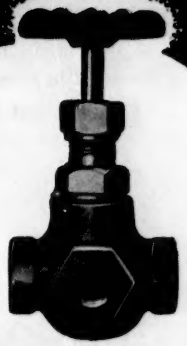

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Kohlenberger services include:

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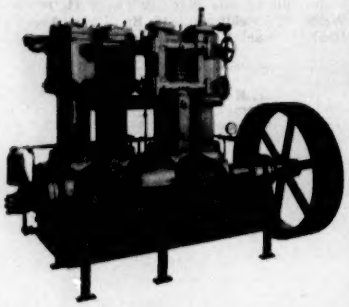

Kohlenberger 100 H. P. heavy duty industrial VSA ammonia or freon compressor. Other models available.

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What's New (Continued From Page 7)

Lined drums by J & L are used for shipment of lithium bromide, a hard to package chemical used in air conditioning systems. These 30-gal. pigmented type lined drums will hold nearly 400 pounds of brine. It is used as an absorbent in water vapor absorption systems.

▶ An Ohio and also a New York firm introduced large diameter pipe of polyethylene. A successful extrusion technique developed by Allied Chemical Corp. enables production of this new plastic with physical properties equal to metal, ceramic and fiber pipes. Useful life expectancy is placed at 50 years, with pressure ratings several times higher than the conventional polyethylene. The material is approved for use in potable water installations.

▶ Although a feature of the show, the flexible air duct previously mentioned was first introduced in Chicago where it met the rigid specifications of the City Building Code. Flame resistant, the material was subjected to a flame rating test prior to introduction. The duct's lining successfully contained a four-foot long flame with an entering 2,000 F temperature, for more than four hours! Available in up to 20-ft lengths and inside diameters of 3 to 12-in, the flexible ducts are ideal for troublesome insullation spots such as branch ducts to ceiling outlets, branch ducts to the high pressure side of attenuation boxes, connections from vertical risers to under window units, etc.

Compact unit pictured can drill vertical, horizontal or angular holes through concrete or masonry at a high penetration rate and low cost, maintaining a noiseless operation, thus simplifying installation of industrial refrigeration piping, conduit or duct.

PIPE BENDS

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the tougher the job, the better our expert metalworkers like it. With their modern equipment, they produce the finest work to your precise specifications. In any metal, even stainless steel, or up to 6-inch extra heavy. For fast, quality bends, backed by nearly 40 years specialization, call on us! May we quote on your next job?

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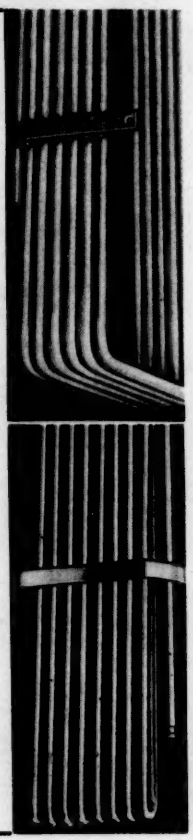

Convention Calls By Warehousing Groups

▶▶▶ INDUSTRY betterment, possible new customer service by refrigerated warehouses, and improved operating methods are the three principal items on the agenda at the National Association of Refrigerated Warehouses annual meeting. The convention will be held in Washington, D.C. at the Statler-Hilton, April 5-9.

The annual meeting of The Refrigerated Research Foundation will be held at the same location April 2-5, preceeding the refrigerated warehousing meeting as has been customary.

Canadians Meet in US

First occasion on which a Canadian Warehousemen's Association Convention has been held in the United States will take place June 21-25. The 39th Annual Meeting of CWA will be held this year at Breezy Point Lodge, Brainerd, Minn. Assistant Managing Director of CWA, A. H. Cole, promises broad and lively discussions on all topics of industry interest. Many US warehousemen plan attendance.

New Canned Meat Plant

▶▶▶ PER CAPITA consumption increase of 38 percent in the canned meat line in the last 10 years, prompted the purchase by Libby, McNeill & Libby of a 55-acre site on Chicago's southside. There, with 14 acres under roof, the firm will construct a $10 million dollar plant to open in 1960 right on the new St. Lawrence Seaway.

Carnation Warehouse

▶▶▶ COMPLETION of an evaporated milk warehouse facility for the Carnation Co. in Maysville, Kentucky, was recently announced. Storage of the canned product is under controlled temperature and humidity. Architect-engineer for the new building was Robert Clements, who recently designed the new Carnation Co. plant in Los Angeles.

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All classified advertisements are payable in advance. Except for Positions and Help Wanted classifications, this section is reserved exclusively for USED equipment.

RATES: 20c per word; minimum 25 words. $2.00 per line for bold face headings: $15.00 per inch for line listings.

Position and Help Wanted

REPRESENTATION WANTED
for broad line of industrial refrigeration equipment. Several territories having an excellent sales potential are available. Write to Imeco Incorporated, 3033 W. Belmont Ave., Chicago 18, Ill.

WANTED — Chief Engineer. Cold storage warehouse, eastern location; maintenance experience necessary. Salary range $6500 to $7500. Give experience, age and reference in first letter. Address Box JA-3, % Industrial Refrigeration.

USED EQUIPMENT—wanted & for sale

WANTED
ADDITIONAL LINES OF EQUIPMENT

Coils—Air conditioners, refrigeration equipment, grills, compressors, condensers, etc., as manufacturers representative in western Michigan. Now have unit heaters, gas conversion burners, small boilers. Two representatives, both men with years experience in air-conditioning and refrigeration with major manufacturer. Wilmot's, 1067 Bridge St. N.W., Grand Rapids 4, Mich.

REFRIGERATION EQUIPMENT FOR SALE
Advise Us Your Needs
Use QUICKSEAL—stops brine tank leaks.
Use CLERTEMPICE—clears and tempers ice.
Born Company 80 East Jackson Boulevard.
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WANTED—Frick two cylinder 11x10 ammonia compressor. Must be in top condition. Prefer with synchronous motor and control. Mack Machine Company of Penna., Inc., 3151 Emerald St., Philadelphia 34, Penna. Phone Nebraska 4-1300.

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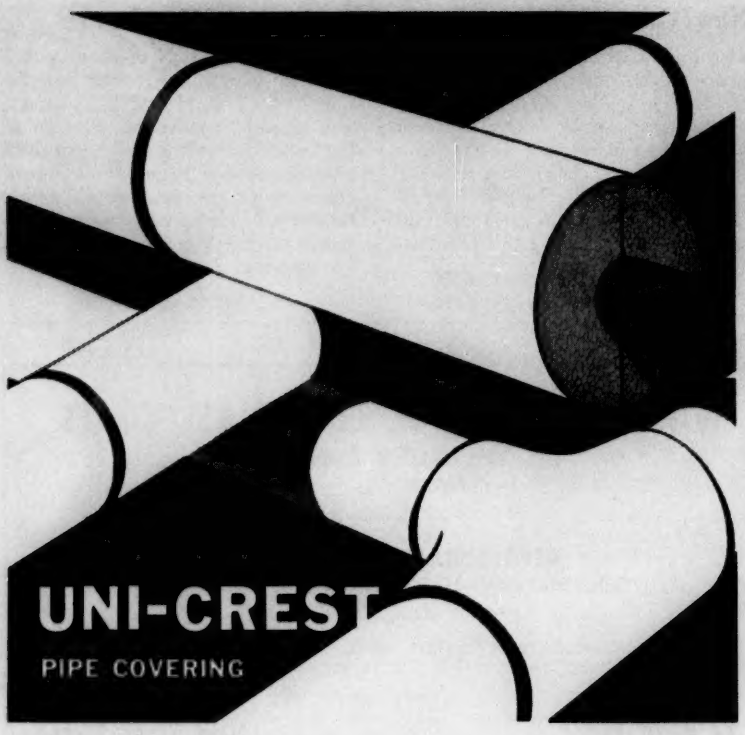

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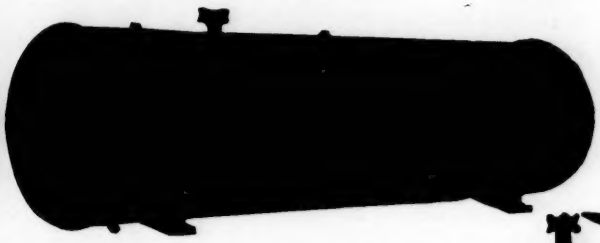

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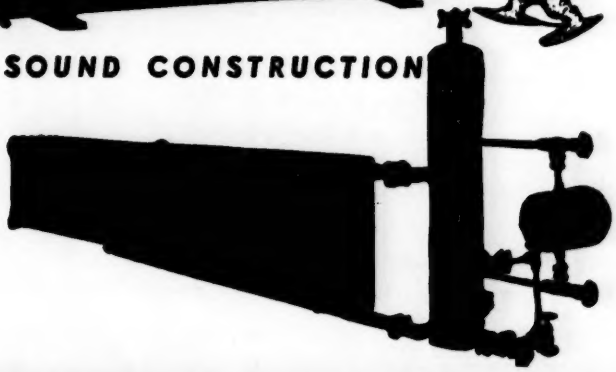

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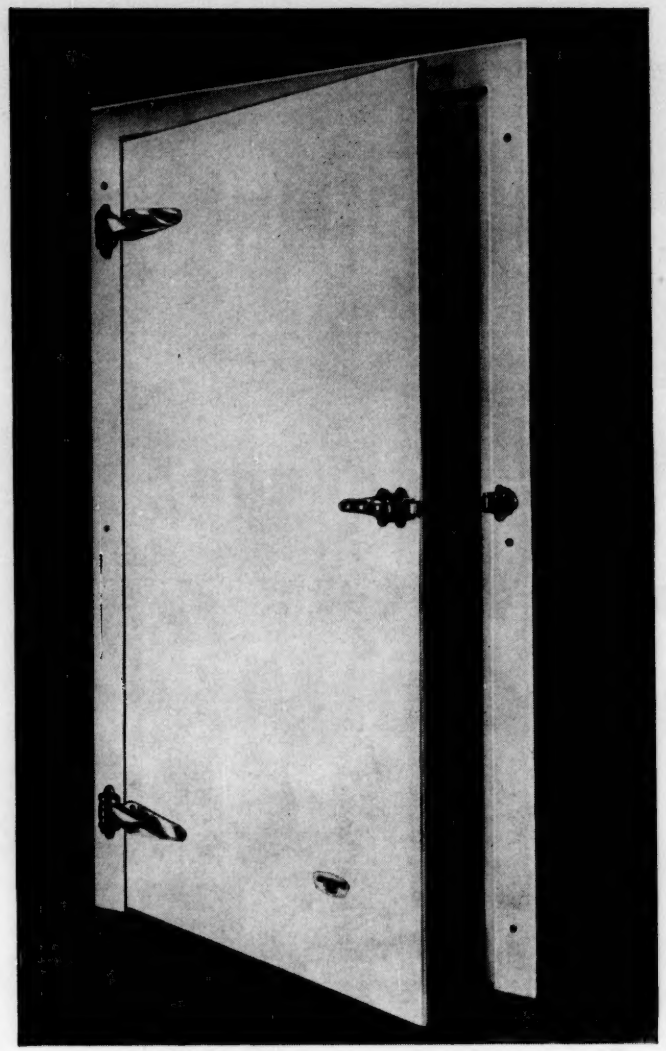

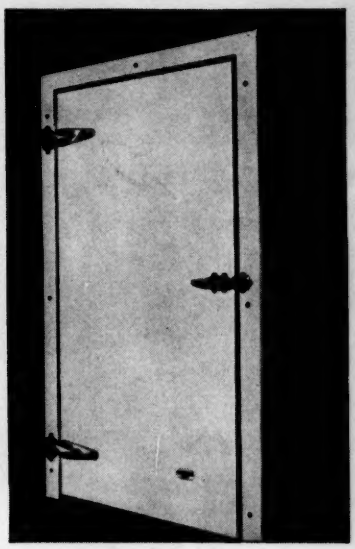

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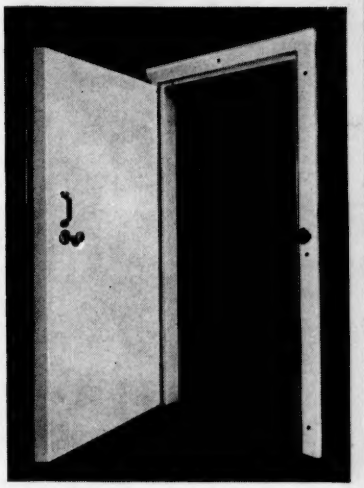

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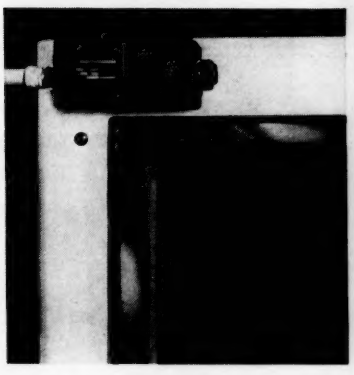

FREEZER DOORS

Jamison FROSTOP is applied to JAMOLITE head, sides and sill to prevent ice formation in freezer use.

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